American Machinist

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Production in Pictures

THE appeal of pictures has always been a strong one to the human race. Before the dawn of civilization paleolithic man developed a very creditable ability to portray his animal contemporaries in color. Some few of his achievements still remain. Ages later when what we now call civilization was in its infancy, men recorded their thoughts and their deeds by pictures long before an alphabet was conceived. As boys, probably every one of you studied the picture writing of the American Indians and even tried your own hand at it.

The power of the printed word is mighty, but it has a long handicap to overcome in supplanting the picture as a means of carrying a message to the mind of man. Witness the growth of our pictorial newspaper sections, our illustrated weekly and monthly periodicals, which are mostly pictures, and last, but not least the motion picture.

Art, as we know it, has long since lost interest in current events, excepting that branch of its devotees who earn a living by drawing caricatures and cartoons for the press, but with the invention and development of the photographic camera this defection is not serious.

The *American Machinist* of a generation ago, like its contemporaries, was largely illustrated with line drawings. There are still, of course, many articles which can only be illustrated in this way, but an analysis will show that the photograph is being used more and more to illustrate machinery and machining operations.

All this is but to lead up to the announcement that on the following pages we have grouped a number of photographs of modern production operations, with no descriptive matter except a brief account of the actual performance record of the process and machine or tool illustrated. Recent strides in the removal of metal from work have been so rapid and so long that few men, no matter how close their contact with the industry, are familiar with them all. We have tried to show some of them here so that they will be evident at a glance. Other groups will be included from time to time, as circumstances permit.

Large scale production is a distinctively American development, and one in which we take great pride. Our continued ascendancy in this field of endeavor, however, will not be possible unless we keep constantly striving to improve our present methods and to invent new ones. A free interchange of ideas and information between makers and users of production machines is essential to such development.

At the present time the important feature of producing parts in quantities is its ability to reduce unit costs. After all, this is the principal aim of the manufacturer, to make his product equal to or better than that of his competitor, and to keep his costs so low that he can undersell the other fellow and still make a fair profit. Modern machinery plays a part, ever increasing in importance, in this contest. You will find pictures of it at work on the following pages.

PRODUCTION

Fig. 1. Machining clutch sleeves in a Lodge & Shipley manufacturing lathe. The eight tools in use make possible the completion of one piece every 18 minutes. The work could scarcely be done in an hour on an ordinary lathe. Manufacturing methods require the use of manufacturing tools.

Fig. 2. Turning a shaft for the selective head of a lathe on a Lodge & Shipley manufacturing lathe in 12 minutes. Diameter and length stops used. Without these stops it required 26 minutes to complete a shaft. Time required to do this work on an ordinary lathe using a single tool would be about 1 hour.

Fig. 3. Facing cast-iron water troughs (both ends) at the rate of four per day in a 25-in. Le Blond lathe.

Fig. 4. Turning, facing and boring two special gear blanks per day in a 22-in. Putnam lathe.

Fig. 5. Turning and facing 18 pulleys per day in a Cincinnati pulley lathe. Double the production of an ordinary lathe.

IN PICTURES

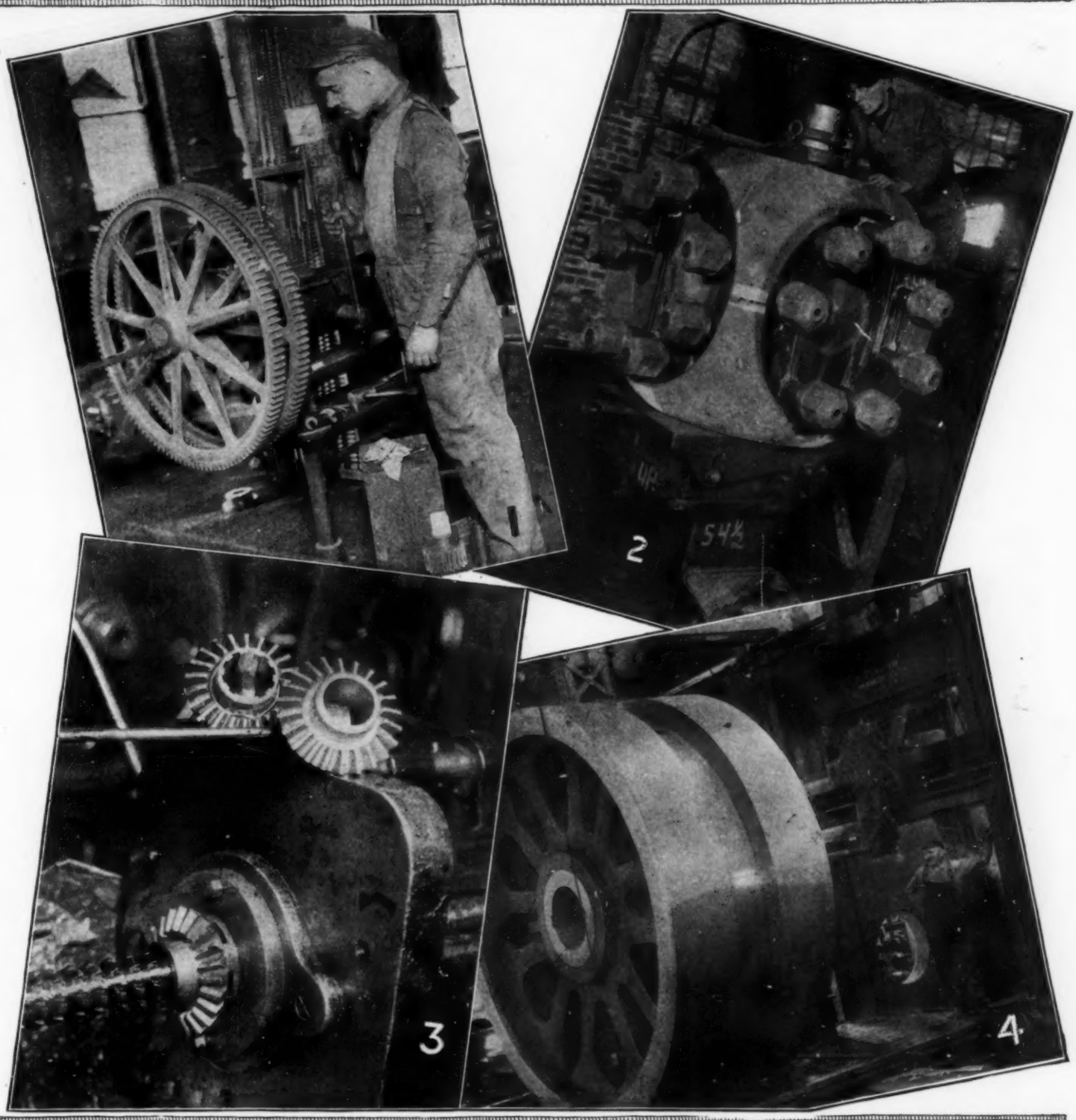


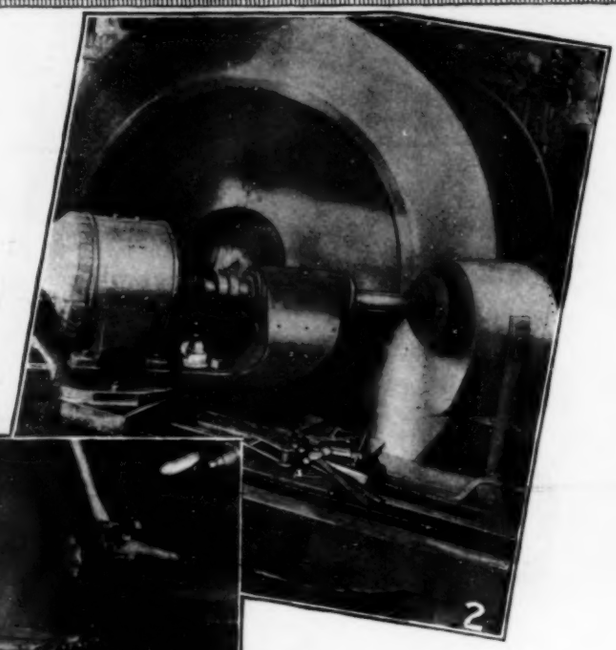
Fig. 1. For quantity work of medium weight there is no better method of keyseating than broaching. 125 of the gears shown have been keyseated on a La Pointe broaching machine in a day. Accuracy is dependent on the broach, not on the operator.

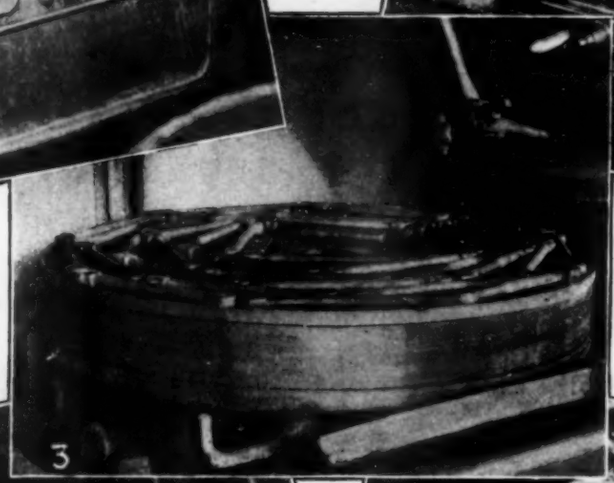
Fig. 2. A keyway 3¼ in. wide, ¾ in. deep and 3 ft. 4 in. long was cut in this 10,000-lb. propeller hub in 1 hour on a Mitts & Merrill keyseating machine. Long keyways of this kind would be an awkward job on a planer with its long overhanging tool.

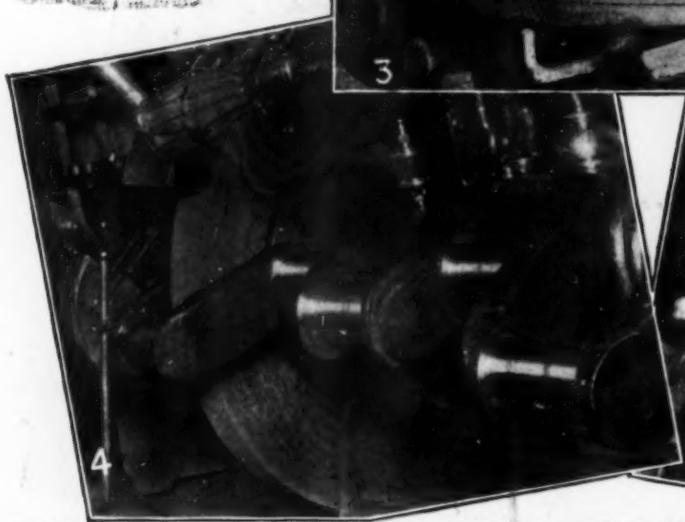
Fig. 3. When multiple keyseats must be accurately cut the broaching method is at its zenith. Broaching 10 keyseats in each of 125 bevel gears, as shown, is only a day's work for the J. N. La Pointe broaching machine.

Fig. 4. A Betts 96-in. planer keyseating a heavy piece of work is shown herewith. This method of keyseating is all right for heavy work or where there is not enough work to keep a single-purpose machine profitably busy.

PRODUCTION







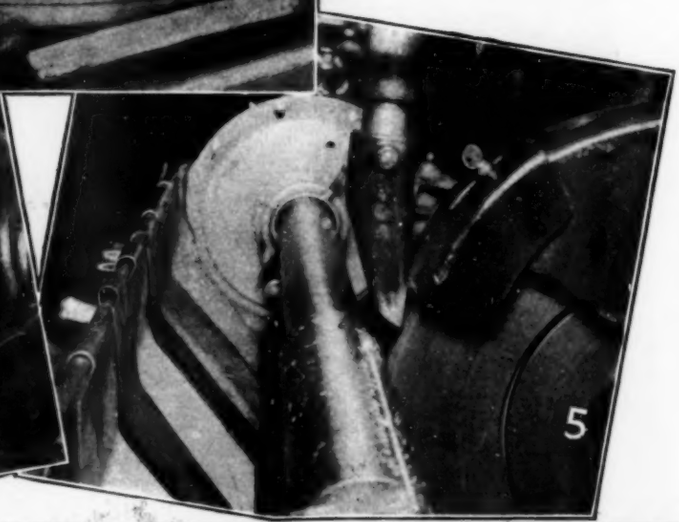


Fig. 1. Small parts are surface ground in large quantities in machines such as the Blanchard rotary surface-grinding machine shown herewith. The work is held on a magnetic chuck.

Fig. 2. The work shown in the illustration is being finished from the rough by grinding. The material is manganese steel and grinding is the only method by which it can be finished.

Fig. 3. Connecting rods can have the flats on the ends finished from the rough by grinding. The tolerance of 0.001 in. in a few minutes. Blanchard rotary surface grinding machine grinds both sides at the rate of 110 pieces per hour.

Fig. 4. Finishing fourteen, 4-throw crankshafts per day is average production on this Landis grinding machine. Such a quantity would require a week if done in a lathe.

Fig. 5. Plain round work used to be finished in a lathe by turning, filing and polishing. Now it is rough-turned and ground. Shafts such as are shown here in a Landis grinding machine are ground to a

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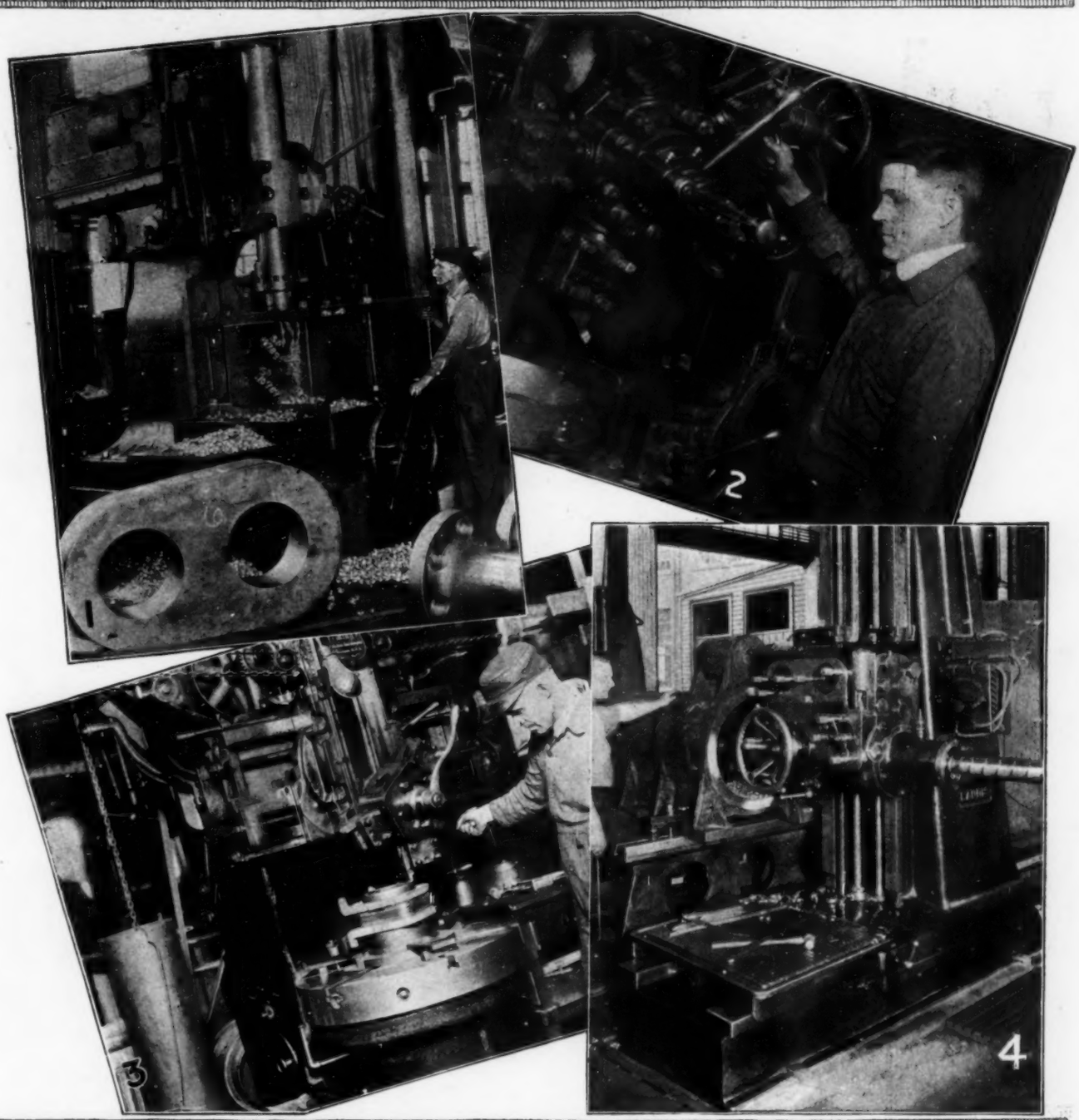

Fig. 1. Boring crank webs for marine engines on a Baker heavy duty boring machine. The holes are 16 in. in diameter, and 1¼ in. of metal is removed from each side with a feed of 0.020 in. per revolution. The webs are bored in pairs, one above the other.

Fig. 2. Boring and turning motor parts on a Bullard vertical lathe at the rate of five pieces per hour. Two pieces per hour would be rapid work if machined in an ordinary lathe.

Fig. 3. Counterboring motor frames for end plates on a King vertical boring mill, turning out seven pieces per hour. Ease of mounting the work added to the absence of tool changing makes possible a production of 25 per cent or more greater than if done in a lathe.

Fig. 4. Boring and facing an hydraulic cylinder for a ship's steering engine in 10 hours on a Landis horizontal boring mill. Before the days of boring mills, where such work had to be done in a lathe, this job would have required 15 to 18 hours.

PRODUCTION

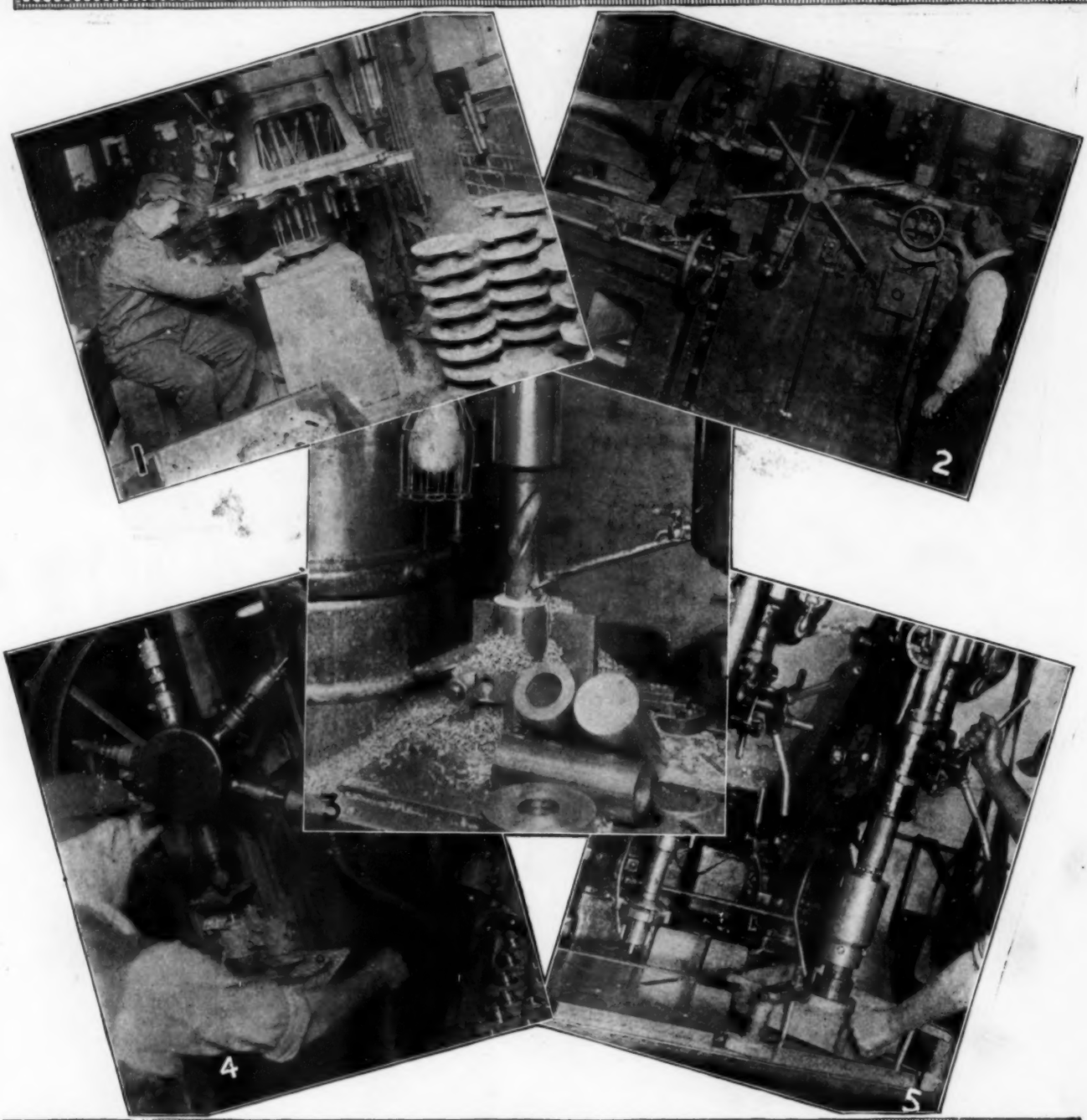

Fig. 1. Drilling gear-case castings in a Baush multi-spindle drilling machine at the rate of 200 per day. Spindles are adjustable as to center distance and pattern. The production is at least six times more than could be turned out on a single spindle machine.

Fig. 2. An awkward piece to handle in an ordinary drilling machine is being machined in this Baker horizontal drilling machine at the rate of two hours per piece.

Fig. 3. Steel sleeves being drilled from the solid in a Fosdick radial drilling machine at the rate of four per hour. The hole is 1¾ in. in diameter and 6 in. deep. Before the advent of high-speed steel drills and machines strong enough to handle them advantageously, this job would have taken from two to three times as long.

Fig. 4. Machining a carbureter body on a Quint turret drilling machine at the rate of 45 per hour. If this work was done in a single-spindle machine, six changes of tools would have to be made and the production would be cut at least in half.

Fig. 5. Drilling machines are used for a variety of work other than drilling. The Barnes all geared drilling machine is tapping 20 pieces per hour, using a 4½-in. pipe tap in cast iron. It would take two men to do this work by hand and the production would not be more than ten per hour.

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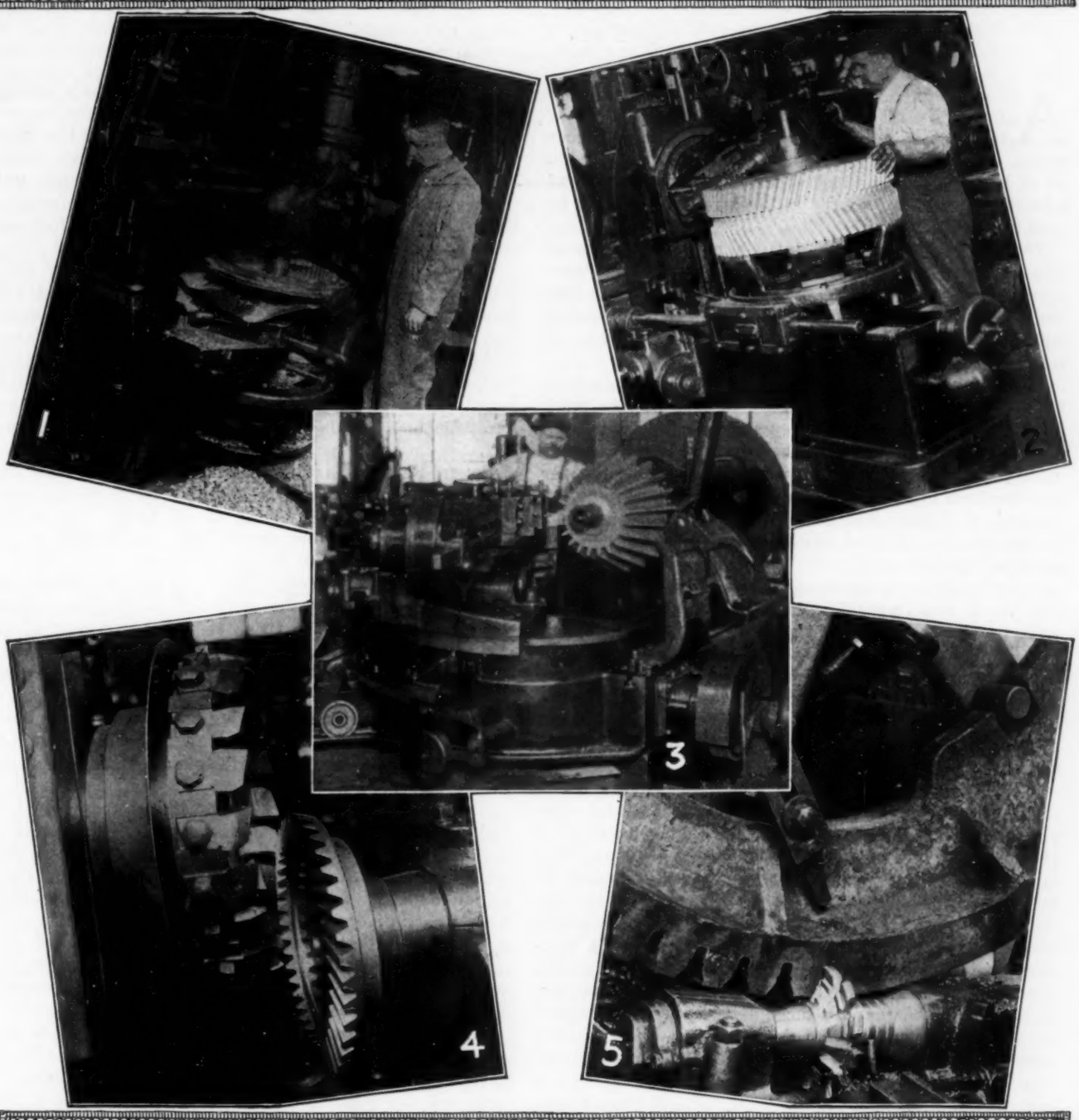


Fig. 1. Generating a 54-tooth, 2-pitch internal gear on a Fellows gear-shaping machine. Production, four per day. Work of this kind used to be done on a slotting machine with a single tool and one gear per day of 10 hours was considered fast production.

Fig. 2. Hobbing a 71-tooth, 2½-pitch herringbone gear on a Gould & Eberhardt hobbing machine at the rate of one per day. Prior to the advent of such machines, but few shops would undertake such a job.

Fig. 3. Cutting a bevel gear on a Gleason bevel gear planer. Two cutting tools are used and the action of the machine is entirely automatic. To cut bevel gears with a single rotary cutter, from two to three cuts and as many settings are required.

Fig. 4. Generating a spiral bevel gear on a Gleason special type machine. It would be almost impossible to produce gears of this kind without a machine designed for the purpose.

Fig. 5. It pays to take a roughing cut with a special cutter on gears of coarse pitch. A 1¼-in. pitch cast steel gear is being roughed out on this Newark gear cutting machine. The finishing cut will be made on the same machine and the total time for roughing and finishing will not exceed 8 min. per tooth.

Crowbars and Economics

The Crowbar Artist and Theoretical Physics—Economic Laws Govern Business and Must be Studied and Followed to Gain Success

By E. F. DuBRUL
General Manager, National Machine Tool Builders Association

A MAN bought one of those stony, New England, Berkshire hillside farms, and proceeded to clear it, preparatory to turning it into a summer estate. He engaged a foreman, who in turn hired a lot of laborers to get the boulders out of the fields and take them to the top of the hill, where they were to be used to build a wall.

The laborers were each given a crowbar, and each told to get out a boulder. Some of these men were crowbar artists; others were crowbar dubs. The crowbar artists got their boulders out with far less tugging and sweating than the crowbar dubs used to do the same work.

If the foreman gave any of the men the wrong kind of a crowbar, even the crowbar artists had to work harder and with less efficiency than should have been necessary to get their boulders out. If the crowbar artists were assigned to boulders that were too big for any one man to get out they soon made it known to the foreman that they had been put to an impossible job. If the foreman insisted, the crowbar artists either laid down on the job or quit it. The crowbar dubs perhaps wrestled with some boulders in utter futility, even trying to do the impossible, and the wages paid them were simply waste of the proprietor's money. The boulders being irregular in shape, the improper use of the crowbar perhaps brought disaster on the user. If his stone was in a peculiarly balanced position, and he set his crowbar in the wrong place, he perhaps toppled the stone over on himself and was carried off the field on a shutter—crippled or dead.

Whichever way they used the crowbars, whether well or ill, they did nothing but apply the fundamental principles of physics. They may not have known anything about the theory of physics, but it was the practical application of crowbar physics that they engaged in when they worked on that job.

Now knowing the theory of physics is not so essential for one who merely uses a crowbar to move a boulder, but it is well to know that theory if one sets out to design derricks for quarries. If the theory of physics is not properly built into those derricks, somebody puts on too big a load and the derrick goes down, causing some money loss, and possibly causing loss of human life. The more complex the structure is, the more a man has to know about his physics. The Quebec bridge went down because of incomplete knowledge, or very bad application of the laws of physics.

The workman uses physics with his crowbar, though he may know nothing about the term. He might hoot at the idea that there was any such thing as physics, but his hooting would not change the laws of physics, and if he violated these laws he would suffer in some way.

But just as most men who are using physics in their daily occupation probably know very little about the theory of physics, very few people who are earning their living know much about the fundamental science underlying business. There are many business men who insist on their machine designers and their bridge designers being thoroughly well grounded in the theory of physics, yet these same men may hoot at the idea that there can be any sense to economic theory. They look on economics as nothing but a lot of fine-spun notions existing only in the heads of college professors. Even a good crowbar artist in a quarry might look on physics in the same way.

The business man is using economics every day. He may be a real artist with his economics, and not know much about fundamental theories of economics. But to the extent that he is successful in his business he has applied economic theory properly. To the extent that he has misapplied it he has failed to reap the full benefit of his tugging and sweating on his own crowbar, and even may roll his business boulder over onto himself.

Roger Babson has been quoted as saying that he investigated the common report that 90 to 95 per cent of those who enter business of all kinds fail before they die, and that he found this impression to be exaggerated—that only 87 per cent fail.

Every year Bradstreet's publishes figures classifying failures according to the cause of failure, and these figures show that only from 11 to 14 per cent of all these failures are due to causes over which the men who fail could have no control. Most failures were due to causes which lay in the control of the men who failed. They used their crowbars wrong and toppled their business boulders over onto themselves. It would seem that for the 87 per cent who fail some better use of the theory of economics would no doubt be of assistance.

Failures destroy wealth as much as fires do. Our failure loss runs considerably ahead of our fire loss in a year. Between the two of them it is estimated that we Americans are destroying at the rate of nearly a billion dollars worth of wealth per annum right now. This waste of essential capital absolutely destroys the accumulation that had been previously made of that amount of wealth. We talk about stopping the fire waste, but when it comes to stopping the enormous failure waste there is not much being done.

There is only one way to stop the failure waste, and that is through business or economic education. Under a free competitive system, which seems to be about the only one the world can work under, every man is free to take his chance—and he should remain free, but others should not be called on to pay the cost of his ignorance. A large amount of futile effort is wasted by ignorant men in getting out their business boulders. Many who do not completely fail waste a tremendous amount of business effort in their work. Economic education is the only palliative for this waste. It has been said that we all learn by experience, but the wise man learns from the experience of someone else while the boob learns only from his own.

Mr. Hurley, when he was connected with the Federal Trade Commission, made a statement to the effect that out of 250,000 corporations in the country at that

time 100,000, in round figures, earned no net income whatever; 90,000 earned less than $5,000 a year, and only 60,000 reported earnings of $5,000 or more per year. He also made the statement that not over 10 per cent of American business men had a cost system of any kind; and certainly what are called cost systems in many cases are not worthy of the name. One could well say that even the corporations that reported $5,000 earnings or more, could well be questioned as to their actual earnings, in view of their lack of knowledge of costs.

A lot of corporations according to those figures were using their crowbars to very poor advantage.

Whenever a workman talks about his job, or a business man about his business they are talking economics, though most of them don't know it, and judged by the final results, in failures, they either use very bad economic crowbars or use good ones very badly. The bigger the bridge to be built the better physicist must the designer be, or stupendous loss results. The world is shocked at the incompetence that caused the loss of two Quebec bridges. But is it shocked at the loss in the rubber tire, the automobile, or other similar industries, due to business incompetence? Not only do stockholders lose, but the workers' loss and the whole business system's loss in one tire concern was far more than the monetary loss from the two Quebec bridges.

What are we going to do about it? Well, for one, I should say that it might be very good for the present capitalistic system to favor some regulation that will permit only properly educated, qualified, tested, and tried executives to have charge of other people's money. Every small stockholder whose savings are lost in a rotten failure feels the injustice of the loss. He has a real kick coming, and unless the real, thinking leaders get busy pretty soon, they may find that many ex-stockholders will gladly turn to something else than capitalism, convinced that the whole system is wrong, just because they had an unfortunate experience with one incompetent or crooked exponent of it.

A stationary engineer is examined and certified as a matter of public welfare before he can engage in an occupation where security of life and property depend on his qualifications. Is it too much to ask that business engineers who manage other people's property should also be required to demonstrate their fitness before going on with the job?

Is that a revolutionary idea? Well, perhaps; but after all, isn't it a good one?

Getting Primed on Shop Methods

BY JOHN R. GODFREY

Old man Johnson has a new hunch and, as usual, there's a good-sized hunk of horse sense tucked away in it. I knew he had been away for a spell and as I had also been out of my usual haunts, helping to play chambermaid to several brands of automobiles and auto-be-automobiles, we'd missed each other for quite a bit.

So I dropped in the other day and ran into Johnson and a man from Cincinnati holding a farewell confab in Johnson's office. After he'd gone, Johnson told me what he'd been doing all summer.

"Been learning a lot this summer, Godfrey," was his opening salute. "I'll let you tell me your adventures later, 'cause I know you had 'em, but just listen to me first.

"I've always thought I was a pretty fair mechanic, John R., and I'm not just willing to take a back seat even now, but its amazing to find there's a lot you don't know, even about some of the simple machines in your own shop.

"Take my cutting-off saws as an example. I happened into the shop where they make 'em, up in York state, and it surely opened my eyes. They were running the saws 50 per cent faster than we did and having less trouble from broken saws, or from heating.

"One of the troubles with us older men, Godfrey, is the fact that we were brought up on carbon steel when 16 ft. a minute was fast cutting. Of course we used Mushet steel a little, but when it comes to the newer steels, we're back numbers. We think we know about what they will do but we don't, unless we actually handle them ourselves.

"Then too, we hadn't been particular enough to keep the saws sharp. I surely was plumb disgusted with myself when I found how much we'd been behind the times. But the saw man sort of salved my ruffled pride by telling me of a big machine-tool builder who was a bigger jack than I, for he hasn't found out yet.

"The whole thing set me to thinking and I wondered how many other machines I had in the shop which were working away below par.

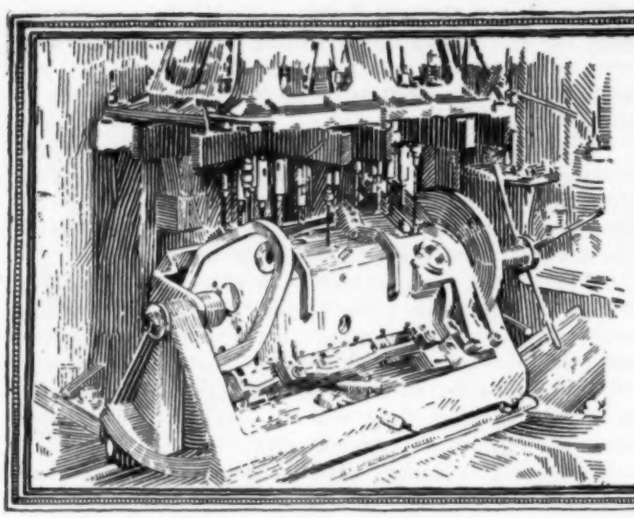
"So I made a sort of survey of the shop—found the different types and makes of machines we had and began a study of production and production methods. Then I visited most of the shops where the machines were made to get pointers on the work they ought to do. It gave me a dern good excuse to go to a lot of shops I've always wanted to see—even though it wasn't an especially good time to see 'em.

"Well I've gathered a good-sized bunch of dope on the work we ought to get from various makes of machines, and I'm tallying up to see how it compares with what we've been actually getting.

"But I'm going further than that. I've arranged with several of the worth-while makers to borrow one of their demonstrators or service men whenever they happen to be in this neighborhood. No need of their making a special trip, particularly as I'm going to pay for their services. Wouldn't take 'em any other way. I want them to come into the shop and do the 'consulting engineer' act for me at so much a throw. We used to jump at the chance to pay some fellow, with a slide rule and stop watch, fifty bucks a day to give us the once over. And dern few of 'em ever had any real shop experience either.

"So I figure it's a whole lot cheaper to pay a thoroughly practical man, who knows our machines, to show us all the kinks and short cuts he knows, than to go on wasting time and money in the old way. And if it happens, which it probably won't, that we are already up to the mark in our machining practice, its worth real money to know it. Then we can save our time and energies for other places where some savings may be possible.

"I'm going to try and have things so that every order means a fair profit, as well as work for the shop, even at the price competition which we'll probably all have to meet. Of course it will cost a little money to do this but it will cost less than to wait and we probably wouldn't have time then anyway. But if no one spends any money how can we ever expect to get business started? You can't eat your cake and keep it too—as the old saying goes."



Tool Engineering

By
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President and Chief Engineer
Albert A. Dowd Engineering Co., New York City

Jaws for Two-Jaw Chucks—Holding Tapered Work—Principles of Chuck Design—Serrated Jaws—The Use of Supports—Special Jaws for Fitting Work

WHEN jaws are to be designed for a two-jaw chuck it must be remembered that as a general thing these jaws are of the "slip" variety. They are usually dovetailed, as shown in Fig. 222 at *A*. This dovetailed portion fits the solid jaw in the chuck and must be made in accordance with the standard of the chuck in which they are to be used. One of the common forms of chuck jaws is the V-jaw used for holding round pieces. It is possible to buy jaws of this kind from the manufacturer or they can be made up in sizes to suit the conditions. Two-jaw chucks are usually applied to work of comparatively small size and frequently the jaws are formed to fit a forging or a casting of a certain particular shape. The jaw in this case then acts as a "nest" into which the piece is dropped and its location in the jaw is determined by the shape of the "nest." In the example *B* the work *C* is a cock which is to be machined on the tapered portion *D*. The jaws therefore are made so that they will grip the ball end as shown at *E*, and at the same time locate the piece centrally by means of the two projecting points at *F*. It is customary in work of this kind to furnish samples of the parts to the toolmaker with a sketch showing the method of location but without giving many dimensions. Instructions are then given to fit the jaws to the model.

In holding tapered work, if the piece is smooth such as that indicated at *G*, it may be difficult to hold it by making two tapered jaws as shown at *H* and *K*. It depends a great deal on what the taper is, but if it is over 15 deg. included angle, jaws of this kind should not be made, as the pressure of the cut on the work is likely to pull it out of the jaws. This is particularly noticeable if the direction of the cutting is such that it presses outward away from the jaws even in the slightest degree. It is sometimes possible to hold work of this kind by notching the jaws so that they will bite into the work, but even this is rather unreliable as the taper of the piece may vary somewhat so that it does not make good contact all along the taper. In order to be sure that no trouble will be caused by an improper method of holding, it is much better to make one of the jaws with a "rocker" like that shown at *L*. This jaw is mounted in a "slip" jaw *M* which is held in the regular way in the standard jaw. The opposite jaw *N* is tapered according to the angularity of the work. When the piece is placed in position the swivel jaw rocks in its seat and adapts itself to variations in the taper. In the design of a rocking jaw the pin *O* should only be considered as a retainer and the thrust of the jaw should be taken on the solid portion *P*.

Two-Jaw Method for Inside Holding

Fig. 223 shows at *A* a counterbalanced flywheel which is to be finished as marked, in one operation. The flywheel was cast with heavy portions at *B* and therefore it cannot be held in a three-jaw chuck. Two special jaws *C* and *D* are fitted to a standard two-jaw chuck body, one jaw *C* being fixed while the other *D* is provided with a rocker or swivel jaw *E*. This rocking jaw is relieved at the center so that it makes a contact automatically at *F* and *G* on the inside surface of the flywheel. The portion *H* is cut on a slight angle in order to assist in keeping the jaw in position under the pressure of the gripping action. Attention is called to the manner in which both jaws touch the work and also the way in which they are relieved to permit the facing tool *K* to operate without interference. Incidentally, tools *K* and *L* are used on the cross-slide of

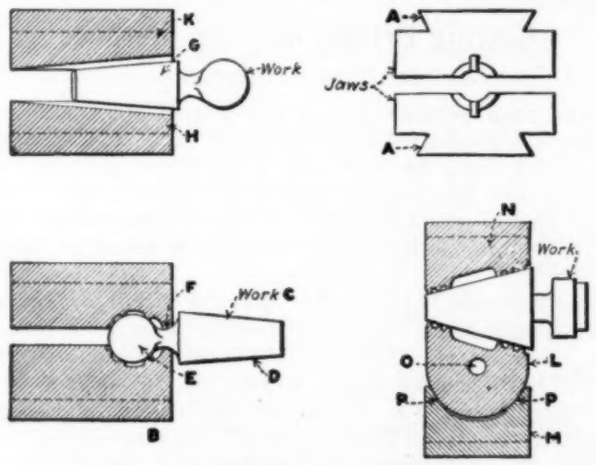


FIG. 222. JAWS FOR TWO-JAW CHUCKS

For the authors' forthcoming book. All rights reserved.

the lathe. The other operations are performed by turret tools with the exception of the surfacing of the hub *L* which is done by a back-facing attachment through the spindle of the machine. The tooling for work of this kind will be taken up in a subsequent chapter.

The work *M* is an angular ball-end lever which has been previously machined at *N*. A two-jaw chuck is used for holding this piece while finishing the ball *O*. The face of the chuck is provided with a locating pin which is a loose fit in the hole *N*. The jaws are of the "slip" variety and are formed to grip the neck of the work at *P*. A small amount of "float" allows the work to adjust itself in the jaws so that the ball portion can be held without difficulty. This example is an instance of a set of jaws which is formed from the model. The drawing would be made with some of the dimensions left off and instructions given on the drawing to "fit to model."

Swivel Jaw Application for Two-Jaw Chuck

An example is shown in Fig. 224 of the application of a combination swivel and special jaw to a two-jaw chuck. The work *A* is roughly rectangular in shape

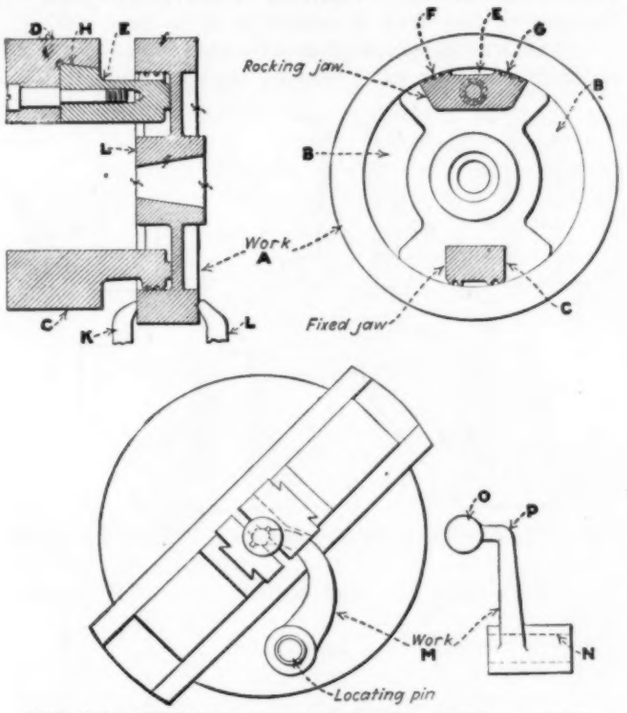


FIG. 223. TWO-JAW CHUCKS WITH SPECIAL JAWS

at one end but irregular on the other end. The jaws *B* and *C* are standard chuck jaws on a special form of two-jaw chuck. On one of these jaws a member *D* is mounted. This is provided with hardened points at *E*, *F* and *G* so that the work rests against the points. The setscrew *H* holds it in place. The other jaw *K* is provided with a swiveling member *L*, having two points at *M* and *N*. These two points adapt themselves to the variations in the casting, thus holding it securely. This particular piece of work is a little out of the ordinary and the method of holding allows the work to be centered and held without distortion.

Principles Involved in Chucking

Errors are often made in designing chuck jaws by attempting to grip the work on too many points without any provision being made for equalization. In our discussion of drill jigs and milling fixtures we brought out the matter of the three point support quite carefully and it should be remembered that the same principle holds good in the design of chuck jaws. Unless care is taken in the design, there is a possibility of an error being made which will cause a piece of work to be held improperly. Let us consider the diagram shown in Fig. 225 in connection with the holding of a cylindrical casting *K* in a three-jaw chuck. The work can be held without difficulty by the three jaws *D*, *E* and *F* in the plane *AB* and it can also rest against one point as shown at *C*. Any other portions of the work which are to be gripped by the jaws must be taken care of by means of adjustable points or screws. If we wish to obtain additional support in the plane *HG* by extending the jaws so as to grip the work in this plane, the result would probably be something like that shown at *L* and *M*. In other words, the jaws would strike at *L* and not at *M*, or it might be just the reverse of this, according to the shape of the rough casting. It might even be that some jaws would strike at *M* and others at *L*, the result of which would be that when cutting tools were put into the work the piece would change its position or vibrate to a considerable extent. It is not necessarily objectionable to design a set of jaws having supports of equal height at *O*, because only one of these points will strike and the others may simply help in chucking the work in the first place to obtain the correct end location. In the example *P* therefore it would be possible to make a set of jaws so that they would bear at *Q* and *R* and although all the jaws would not strike at *R*, one of them would, which would be sufficient to obtain the location.

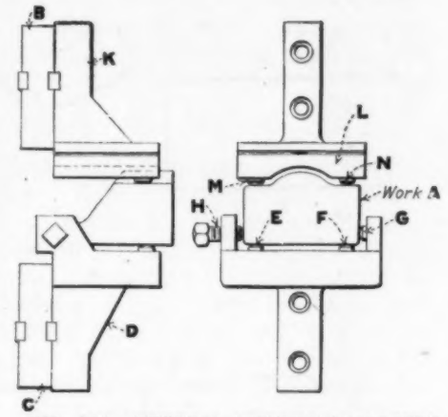


FIG. 224. SPECIAL TWO-JAW METHOD OF CHUCKING

Many kinds of work can be held in standard jaws either by the outside or inside. Fig. 226 shows an example *A* in which the work *B* is being held by the outside in the set of standard jaws *C*. The example *D* shows a piece of work *E* being held by the inside in a set of standard inside holding jaws *F*. Work of this kind seldom requires special jaws unless it is so thin that a facing operation cannot be done without running into the jaws, in which case special jaws might be made similar to those shown.

In production work it is advisable to standardize jaws as far as possible and avoid the changing of the entire jaw in any chuck. By means of standardization, jaw blanks can be made up like those shown at *G* and they can even be fitted to a master plate so that the only work necessary in making up special jaws will be the cutting of the jaw blank into the desired shape. Of course there are cases where special blanks are required, but in most cases certain standardized heights can be utilized if they are made up as indicated.

Fig. 227 is given in order to illustrate several important points in connection with the chucking of cylindrical work. The piece *A* is to be machined at *B*, *C*, *D* and *E* and it would normally be held for this purpose

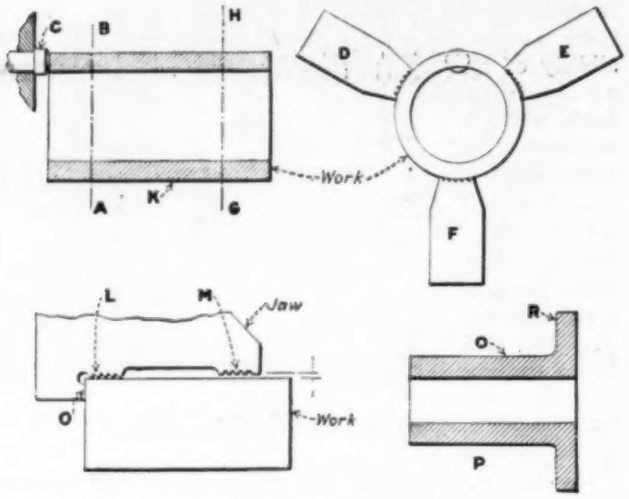


FIG. 225. PRINCIPLES INVOLVED IN CHUCKING

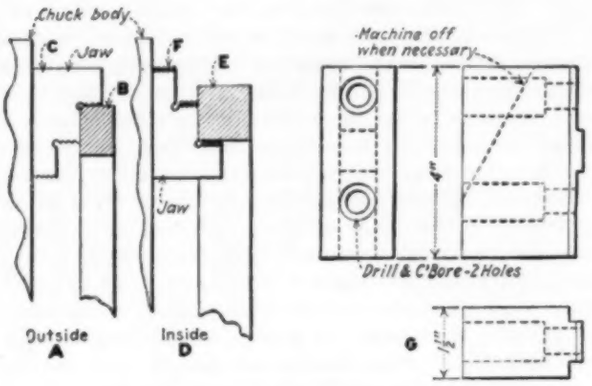


FIG. 226. STANDARD CHUCK JAWS

in a three-jaw chuck by the outside of the hub. A casting of this sort is likely to come from the foundry in about the shape indicated by the dotted lines at *F* rather than as shown on the blueprint. In other words the patternmaker will naturally allow some draft in order that the piece may be easily removed from the sand. If then an attempt is made to hold the work in a set of chuck jaws like that shown at *G* the result will be a contact only in the plane *HK* so that there will be very little gripping action to the jaws and the piece is likely to be considerably disturbed while the cutting action is going on.

In order to avoid such a condition, it is common practice to make up the jaws to correspond with the taper on the casting as shown at *L*. We wish to say a word against this practice because it is very seldom satisfactory on account of variations in the casting. Sometimes it will be found that the work will be gripped by the portion *M* which allows the front end of the casting to "wobble." At other times the portion *N* may hold the work and then there is not sufficient gripping action to hold the piece firmly. Trouble is usually caused by variations in the casting which may be caused by several different patterns being used or by the work being cast in several places. It is much better to use a set of jaws like those shown at *O* or *P*. In the case of the jaws at *O*, the work is gripped and centered at *Q* and it receives additional support from the screws *R*. The other method shown at *P* involves the use of two jaws with rockers as shown at *S* and one jaw formed to the approximate taper of the work. This latter is undoubtedly the best method of holding a piece of this kind although the method shown at *O* is considerably cheaper and will answer the purpose in the majority of cases. It is open to the objection that the operator may fail to tighten the screws sufficiently, or he may tighten them too much, thus distorting the piece and making it untrue.

Method of Serrating Jaws

If a design for chuck jaws is made and sent to the factory or toolroom to be manufactured without specific instructions, the result is likely to be disastrous. It is seldom that a tool designer gives sufficient attention to this matter in making his drawing. It is a very good idea to examine some of the standard jaws that are put out by the chuck manufacturers and note the method used in serrating them. Fig. 228 shows the correct and incorrect methods of serrating jaws. In the case of the work *A*, which is to be held, the piece is cylindrical in shape and somewhat long so that in order to obtain a good bearing on both ends it would

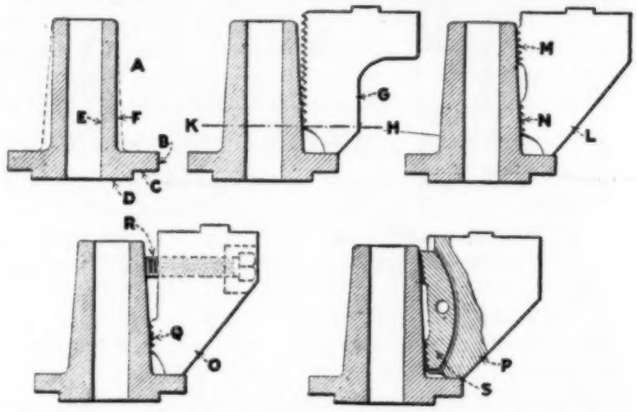


FIG. 227. SEVERAL METHODS OF CHUCKING A FLANGE

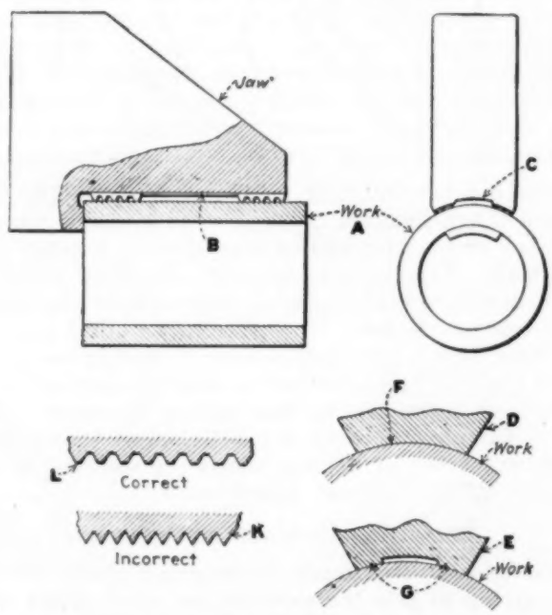


FIG. 228. METHOD OF SERRATING JAWS

be advisable to relieve the jaws at the point *B*. It is also advisable to relieve the jaw in the other direction as shown at *C* as this will give a better gripping action on the work than if the serrations are carried the full width of the jaw. The conditions obtained are shown at *D* and *E* in an enlarged view. If made as at *D* it is quite possible that a contact on the surface of the work will only be made at *F*, while if relieved as at *E* it is certain that a good gripping action will be obtained at both points *G*.

In the cutting of the serrations in the jaw, care should be taken never to bring these up to a sharp point as shown at *K*. If jaws are made in this way the points will soon become dull or broken and the gripping action will be injured. If made with a slight "land" as shown at *L* the surface will continue to be hard and there will be less chance of breakage. A "land" of $\frac{1}{32}$ in. is sufficient and the angle of the cut can be any where from 15 to 30 deg. depending on conditions. It is customary to make lands wider where they grip the work as at *G* than they are in the other direction. They are often made $\frac{1}{16}$ in. in this direction. Chuck jaws are usually made from machinery steel and pack hardened.

Supporting Spider for Chucking

When work is rather large and fragile and must be held by the outside diameter there is a tendency to distort it unless some provision is made against it. Fig. 229 shows an example of this sort in which the work *A* is held in special jaws *B* by the outside of the flange. This work would be very much inclined to become distorted both in the chucking and also in the machining unless something were done to prevent it. There are three supplementary blocks *C* placed midway between the chuck jaws. Screw jacks *D* are set in each of the supporting blocks so that they can be adjusted to support the flange between the jaws. In addition to this, a loose spider *E* having three setscrews at *G*, *H* and *K* is utilized. These setscrews are set out until they support the work opposite to each one of the three jaws. A hole is provided in the middle of the spider so that boring bars and other tools can be used to machine the work. The use of a method of this kind makes it possible to machine this piece without either vibration or distortion.

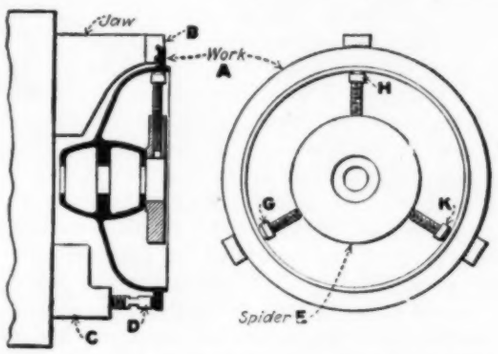


FIG. 229. SUPPORTING SPIDER FOR CHUCKING

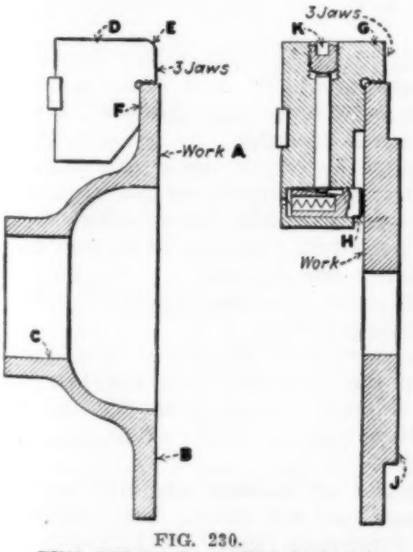


FIG. 230.
TWO TYPES OF SPECIAL JAWS

Two Types of Special Jaws

Fig. 230 shows a piece of work at *A* which is to be machined at *B* and *C*. A set of special jaws suited to it are shown at *D*. The jaws are so proportioned that the face *E* lies back of the machined surface *B* and the work rests against the jaw at *F*. This method of support would be sufficient for a piece of work like that shown, but if the work were larger and was to be machined on a broader surface like that shown at *J*, additional support might be necessary. To provide for this a set of jaws could be made like that at *G*. These would grip the work and locate it in much the same manner as those previously mentioned, but an additional support is provided in each jaw at *H*. This is a spring jack which bears against the surface of the work and which is locked in place by the pin and hollow setscrew at *K*. For work which is very thin and which requires considerable machining over a broad surface, a method of this kind would be found satisfactory.

Welding Broken Armature Shafts Without Removing Coils

Large armature shafts occasionally break at the junction of the journal and the pulley end. While recognizing the adaptability of the thermit welding process to the welding of all kinds of large steel shafts, operators sometimes in this case decide to scrap the old shaft, fearing that the heat of the steel produced by the thermit reaction might injure the armature coils and produce short circuits.

Where the armature coils, however, can be separated from the fracture by a few inches of molding sand (at least about 4 in. in the case of a 3 in. diameter shaft) a repair by this method is entirely feasible without injuring them, according to a statement by the Metal and Thermit Corporation, New York, if the following simple precautions are observed. There is no danger of damaging the armature windings through the effect of direct heat as the fracture is completely surrounded by molding sand and all preheating subsequent to heat from the thermit steel is confined within this molding sand. The heat which is conducted along the shaft is readily taken care of either by directing an air blast on the shaft or, where necessary, by means of a specially constructed water cooler box with packing box on the shaft to prevent the possibility of any water whatsoever coming in contact with the windings. The windings themselves are further protected by being totally encased in an oil cloth and burlap bag.

In case the keyway of the pulley end of an armature shaft becomes badly worn, this worn end can be removed and a new over size extension welded on and machined down. A large number of such extensions have been thermit welded in the past.

Organization and Management of the Small Shop

VII. Filling the Customer's Order—Necessity of Keeping Records—The Sales Value of Real Service—Efficiency in the Shipping Room

BY E. W. LEACH

THERE are two important reasons why you should give special attention to the various details in the process of filling the customer's order. One is for purposes of record. In the early days of your business career when you are most concerned with seeing it "over the hill," and when a great many things that you would really like to do are pushed aside until some later and more convenient time when you will not be so personally tied down with an active part in actual production work, there is an ever present tendency to be lax in taking

SURE - SAFE AUTO LOCK COMPANY
SHIPPING ORDER RECORD

ORDER NO	SHIPPED TO	FORD-21	FORD-BR	7R	9R	MISC.	RECD	ENTERED	SHIPPED
1751	J. H. Lund & Co.			3	3		3.20	3.20	3.21
1752	Austin Motor Co.	1					3.20	3.20	3.20
1753	A. E. Liffy & Co.	1					3.20	3.20	
1754	A. T. Johnson		1				3.20	3.22	3.22
1755	King - Hall Co.			6			3.20	3.20	3.20
1756	Thomas A. E. Liffy Co.			1			3.21	3.21	3.22
1757	Thomas Mfg.						3.21	3.22	3.22

FIG. 7. SAMPLE FORM FOR SHIPPING ORDER RECORD

proper care of office work and in keeping records that will be valuable to you later on.

You should be especially careful to keep detailed order records (Fig. 7.) from the time you make your very first shipment. After those goods have been in use for a time, replacements of parts will become necessary, customers will want to turn in old machines toward new ones, and in other ways requests will be made which will necessitate reference to the original shipment.

Advantages of Available Records

Your product will change in details of design and construction. You will not want to be making exactly the same kind of goods a year from now that you are making today; you will be constantly improving them here and there in minor ways which will mean changes in the construction of certain parts. Possibly the construction of your machine included a certain shaft that was originally made from $\frac{3}{4}$-in steel. Later you strengthened your machine and changed this shaft to $\frac{7}{8}$-in steel. If a customer writes in for a pulley or a bearing for his machine and you send him one with $\frac{3}{4}$-in bore, you can imagine his disgust when he receives it and finds it does not fit his shaft. Possibly his machine has been idle while waiting for that new bearing. If he has to return the bearing you sent him and ask for another one, it will not be very easy for him to boost your company to his friends. And don't forget that the best sales force you can have is the men who are using your product.

Let your imagination pass over a period of ten years and carry you into your plant at that time. Maybe you will have fifty employees in your offices alone. If a customer writes in for some part that he needs for his machine and your order records date back to the time of his purchase years before, so that you can know with certainty that he will receive the correct part, those records will possess a value to you that you cannot measure.

The second important justification for careful attention to order records is that they can be an effective means of improving the service to your customers.

What Service Consists Of

Service—the mere word—is almost threadbare with overuse. The expression, "We give service," has been used to cover such a multitude of sins that its effect on most of us is reactionary. You can *talk* service, or you can *practice* service. If you practice it honestly and whole-heartedly, you won't have to talk about it.

The best chance for you to give real service to your customers is in attending to the various details in connection with filling their orders. It is not sufficient to see that the goods are put into the mail or delivered to the railway company without a single moment of unnecessary delay. That is only one part of it. The success you experience in taking advantage of the opportunity to build business through filling orders depends upon the ability to put yourself in the other fellow's place.

Suppose you are located in Chicago and a customer in Seattle sends you an order. He knows that it takes three days and three nights for that order to reach you, and so he reasons in just a week after he mails the order he should get some word from you. If the word doesn't come the exact day he expected he thinks something is wrong. If a week more goes by and he hasn't heard from you, he wonders if his letter has gone astray, and so he writes to learn whether it reached you or not. Maybe the order was small and he sent a check with it. He gets his statement from the bank ten days later and finds you lost no time in depositing his money. Just put yourself in that fellow's place, and tell yourself truthfully whether you would ever send a second order to that company.

All of this time the order may have reached you and been filled and shipped that same day, so that from that one standpoint you acted admirably. But, oh, how you have fallen down when you consider the transaction as a whole.

Men, that's not giving service. It's falling far short of the mark you should aim at in every sale you make. A customer expects something more than the actual goods when he gives you an order. He has a right to expect something more, and often times your reputation with him and the possibilities of your ever receiving a second or a third order from him depend not so much on the actual thing he bought from you as on the manner in which the order was handled.

One of the first iron-clad rules that you should establish in your organization is this:

> Acknowledge every order the day it is received. If possible, tell the customer when and how his order will be shipped. If you need any further information before you can fill the order, go after it.

Your acknowledgment of the order need not be anything elaborate, a post card will suffice. Your customer is interested in the message itself, not in the fancy way in which it is presented to him. Some such word-

ing as this on a post card will serve amply for acknowledging orders:

Chicago, Illinois,
....., 19....

Gentlemen:
Thank you for your order.....
just received, for.....
.....
We expect to make shipment.....
by.....

Very sincerely yours,
BLANK MANUFACTURING COMPANY.

This will tell your customer when his order reached you. It will check his order number and the item or items specified. It will tell him when the shipment will leave the shop, and if by parcel post, express, or freight. You should make some notation on the customer's original order to show that it has been acknowledged, either by a special stamp provided for that purpose, or a date stamp, or even a mere pencil note, "Ack'd 4-17-21, shipment promised 4-20-21."

A great many times, unfortunately, you will not be able to fill an order from the information it gives. It may be there are certain specifications lacking, or the prices may not be correct, or the items may be described in an unusual and confusing way. At any rate, filling the order from the information you have would be taking a chance on making a mistake.

In general, there are three types of orders; those direct from customers, those from jobbers or dealers for shipment to their own stock, and those from distributors for direct shipment to their customers. In the first two cases you are dealing with one party, in the third there are two parties to be considered. In either event, don't leave the responsibility up to anyone but yourself if you are anxious to give service by avoiding delays.

Where a dealer has ordered a certain item to be expressed direct to his customer in another city, if you needed further information you might write to the dealer somewhat as follows:

Gentlemen:

Your order of the 17th for one Sure-safe Auto Lock to be shipped to the Ford Sales Co. at Wichita, Kansas, has been received and entered for attention.

However, we cannot make shipment until we receive further information from you, as your order does not state whether this lock is to be installed on a 1921 model car or an older model.

If you will give us that information, the lock can go forward to your customer at once.

Very sincerely yours,
SURE-SAFE AUTO LOCK CO.

Here's where such a letter falls down; it puts the decision up to someone else, and in this case, offers three chances for delay. The jobber in Kansas City may not write promptly to his dealer at Wichita, the dealer may not reply immediately to the jobber, and then the jobber may not get the information up to you promptly. All this time someone somewhere is waiting for a lock for his car, and if that lock is to come direct from the manufacturer, it is the manufacturer who will be blamed for any mistakes or delays.

How much better it would have been for you to write to your jobber as follows:

Gentlemen:

Thank you for your order of the 17th for one Sure-safe Auto Lock to be shipped to the Ford Sales Co. at Wichita, Kansas.

Your letter does not enable us to fill the order immediately and be certain of sending the correct lock; but we enclose copy of a letter we have sent your customer today explaining how the matter has been handled.

Very sincerely yours,
SURE-SAFE AUTO LOCK CO.

And then the following letter to the customer at Wichita:

Gentlemen:

Thank you for your recent order just received through the Auto Supply Co. of Kansas City for one Sure-safe Auto Lock.

The order does not state whether this lock is to be used on a 1921 or an older model Ford car. Ninety per cent of our locks are installed in new cars at the time the car is sold, and we presume that it is your intention to use this lock on a new car you have just placed with some customer in your city.

The order has been entered according to that presumption, and unless we receive contrary instructions before a week from today, the 27th, it will be expressed to you on that date.

Very sincerely yours,
SURE-SAFE AUTO LOCK CO.

See the difference? You will if you put yourself in the place of the distributor in Kansas City. If you received the first letter you'd probably say to yourself, "Oh Thunder, isn't that order taken care of yet? Now I've got to write a couple more letters about it." But if it were the second letter, you'd say, "Gee, those are fine people to do business with. Look at that; wrote to the customer themselves, and took care of everything for me. That's real service."

TAKING THE INITIATIVE

In handling orders from customers, don't leave things hanging fire. Make a decision one way or the other, tell the customer what you have done, and that you presume it's as he wished. If it is all right, the order will go smoothly through routine channels and be filled and billed. If it isn't all right, your customer will be sure to let you know in a hurry. You will put the proper spirit into your work if you keep before you the fact that every letter you write is a sales letter. Even a collection letter or a reply to a complaint can be made to sell goods if you put your message across in the right way.

Every action on your part calls forth some sort of reaction from your customers. Every detail of your service creates a good or bad impression, it either builds your business or tears it down. If you can get the men in your shop to realize that fact, and to sail into their work with the knowledge that whatever they may be doing individually is a necessary part of the main job —that of filling customer's orders—you will not have to worry about buyers' strike, labor turnover, or kindred problems which trouble so many manufacturers.

THE SHIPPING ORDER

Each order should be transferred onto a shop form which would probably be known as a "Shipping Order." The orders as they come in the mail from your customers will be written on a great variety of forms, letters or cards. Some of them will call for more or less interpretation, and quite often specifications will not be worded according to catalog terms with which the men in the shop are familiar. To eliminate the element of guesswork and the liability of mistakes in shipping, it will be best not to let these original orders go out into the shop. Then too, they should be available for reference, which would necessitate their being kept in the office files.

A large plant is just as much concerned as anyone in preventing unnecessary expense, but the element of economy is not taken into consideration in quite the same way as in a small shop. There, the addition of some new printed form quite often brings up a "where'll we get the money to pay for it" problem. While from some standpoints it might be desirable to have a separate form for a shipping order, the writer found in his small shop that a duplicate copy of the invoice served this purpose very well.

The invoice under those circumstances would be made out in triplicate at the time the order was received. The original copy is kept in some file according to your own convenience until shipment has been made. The duplicate copy is sent into the shop where it is used by the shipper as an order for packing and shipping certain goods. He will check the items as they are filled, and show the date that shipment is actually made. Copies for orders shipped should be turned in each day with bills of lading or express receipts. When the duplicate copy comes back to the office, it is then only necessary that you fill in the shipping date on the original and mail it to your customer. The duplicate copy is filed in a binder and acts as a copy of invoice from which postings will be made to the various accounts in your sales ledger. The triplicate copy need not be a ruled form like the first two,—just a plain sheet of manila paper will do. It is pinned to the customer's original order, and goes with the correspondence into the closed order file as a part of that record.

Packing Goods for Shipment

In instructing your shipper as to the necessity for extreme care in packing goods for shipment, you can illustrate your lesson by telling him about the lady in New York City who brought a dilapidated suitcase to the expressman at one of the stations and asked, "Will you tell me if this suitcase will go by express to my son in San Francisco?" The agent dropped the suitcase on the floor and said, "That's for Chicago." The second time, "And that's for Kansas City." The third time, as he dropped it on the floor and said, "That's for Denver," the contents of the case spread out all over the floor, and the agent said pleasantly, "No ma'am, this suitcase would never have gone by express to Frisco."

A good way to test the security of your packing or crating is to send a shipment to some city on the other side of the country. When the express agent or the railway freight agent advises you that he is unable to locate the consignee, instruct him to return the shipment to the factory. After that box or crate has done double duty in that way, you will have a good opportunity to discover whether your machines are arriving at their destination in good condition.

Always mark each box or crate in some way so it can be easily identified by the customer. The simplest way is to show the order number under which the goods are being shipped. This will be especially appreciated by jobbers or dealers who may want to put the goods in warehouse stock or reship them to customers without unpacking them. If the dealer can identify each box by a number and know just what is in that box by looking up your invoice bearing that same number, he can save himself the expense of unpacking your goods, storing them on his shelves, and reboxing them again later. And when you can help your dealers to cut down their expense, you'll increase their desire to do business with you.

A record of delays is always desirable, although you may not feel that it is essential excepting at those times when you may be badly behind on deliveries. If the nature of your product is such that orders cannot be filled immediately from stock, such a record should surely be kept. This record can be kept in book form, and to be of complete value should show:

Order number,
Party to whom shipped,
Goods specified,
Customer's number or date,
Date received,
Date entered,
Date shipped.

When your volume gets up to the point where you receive several orders a day, this record will permit quicker reference to any particular order than if you had to search through filled and unfilled orders, or ask someone out in the shop. It shows what service you are giving on shipments, and enables you to select the oldest unfilled orders so that they will be taken care of first. It acts also as a sort of sales record to show what quantities of each product or item you are selling. And by listing the unfilled orders at any time you can figure the amount of unfilled business in the house at that time.

In a previous chapter I said we are all in business for the same purpose,—to sell goods at a profit. That is true, and yet it is not alone the selling of your goods that will build up your business. In order to meet your payroll and your accounts payable, you must have a steady stream of money coming in from your customers. Bear in mind that (excepting in the special cases of C. O. D. or cash with order shipments) your customer is not going to enter your invoice for payment until he has received your shipment and found it to be correct and satisfactory.

The money comes in exactly as the orders go out. If you have a superficial, half-hearted way of filling orders and if you bunch up invoices at the end of the month and then make a mad rush to get them out before the statements, you can expect collections to be poor. But if you jump onto every order with both hands and feet the minute it reaches you, acknowledge it, get the goods on the way, and mail the invoice, you've handled the whole transaction in a way that just about obligates your customer to prompt payment.

Necessity of Planning for "Repeat" Sales

If you only plan to sell each customer a single time, your business is only temporary. Even though every individual in the country might be a possible purchaser of your product, you could say right today how many prospects for sales you had. But that figure would not begin to mean that you would sell that many items. Somebody else might break into the same field with a little better proposition, and then all your calculations would sadly miscarry. But if you can bring the element of "repeat" into your business, you have gone a long way on the road toward sure success. A salesman may make a most unusual commission for selling your machines, but if he fears he will be thrown out the back door if he shows up a second time, he's not going to enjoy his position as your representative. When he knows that he can drop in on his customer six months later, find a ready welcome, and hear a story of satisfaction, he'll be tickled to death to boost your products at every opportunity.

SATISFACTION is something that you have to sell along with your product. That's the element that will make repeat customers of your purchasers. You sell satisfaction partly through the merit and dependability of your product, and partly through the good-will you can establish by the service you render. The service that really counts is not the sort of stuff you see emblazoned on billboards throughout the country.

Sometimes we read a book or see a play that we like, although we may not be able to explain just wherein we thought it was exceptionally good. And so it is with real service. Oft times the customer may not be conscious of each detail that has contributed to his satisfaction, but they have had a cumulative effect that has pleased him.

The various details of filling the customer's order offer unlimited opportunity for developing a real service that can be one of the most vital factors in the building of your business. It's a problem worthy of your best thought; and the effort you spend in making it pleasant and profitable for people to order goods from your shop will react many times over in the form of continual increase in the volume of your business.

In Favor of Uniform Cost Methods

BY J. BAINTER

Builders of machinery and machine tools would do well to follow the development of the idea of uniform cost systems. These systems call for the use of uniform methods of figuring costs in any industry where the work done in various plants is very similar, the costs being compared so that enlightened competition may result.

The Fabricated Production Department of the Chamber of Commerce of the United States, Washington, D. C., is endeavoring to further the growth of the idea, and has already accumulated information regarding seventy uniform cost systems. It recommends that trade lines not so equipped take immediate steps to develop some uniform systems. The department recently entered into correspondence with the Federal Trade Commission at Washington to determine the attitude of that body on the subject. Its inquiries were as follows:

"There is, however, one point we should like to be informed on, and that is your attitude toward 'uniform cost accounting' and its use by members of trade associations.

"We refer to a standard plan or methods which may be developed and used by the producers of a certain line whereby they figure their costs by the same rules, including in them the same elements and differing only in results because of the variance in size of plants, equipment and local conditions—uniform as to fundamentals.

"Is there, in your opinion, any reason why such a system may not be developed and used lawfully by an industry? Again, if conversion costs only be dealt with, is there any legal bar to the collective study of costs by the members of an industry using such a uniform cost system?"

The replies of the commission, given in part in the following paragraphs, show its friendliness toward the idea:

"There has been much misunderstanding and unfortunately not a little misrepresentation of the attitude of this commission on the subject of uniform methods of cost accounting. In fact it seems to be difficult to secure even from the most carefully worded statement a proper appreciation of the commission's position, yet it is really very simple, namely, that it is strongly in favor of such work, provided it is done scientifically and accurately and is not used for ulterior purposes in violation of the law.

"No governmental agency in this country except possibly the Treasury Department has had so much occasion to observe the existing defects in cost accounting methods, but the commission is glad to record its opinion that there has been on the whole a considerable improvement in recent years. The work of this commission would be greatly facilitated by further improvement in cost accounting methods and also in fact by a greater uniformity in methods, provided proper methods are chosen as the models.

"As long as the principles of cost accounting are sound and the methods used are adapted to secure accuracy of individual results, and provided that the results are not used directly or indirectly for ulterior purposes of an illegal character, the Federal Trade Commission is in favor of the study and development of uniform cost accounting by trade associations, or otherwise.

"There is evidently nothing illegal in such a practice, but it is always well to remember that though innocent in itself, it has sometimes been perverted to serve the ends of collusive price control; and, when it is so used, no matter whether directly or indirectly, then restraint of trade is involved."

In a later letter more is said regarding the value of uniform cost systems and the legal aspect of them, some of the chief paragraphs being:

"Stated in another way, the conception of the commission is that the efforts of a trade association to educate the individual member in the application of sound principles of cost accounting in his individual business, are proper. But that any subsequent effort of the association to reduce the individual costs to an average or uniform cost basis and to procure the use of the group standard as a basis of price making by each of the individuals in the group, is improper. The individual must fix his own cost and his own margin. The group may not attempt to substitute a group average or standard either of cost or margin for the individual's figures without being in peril of becoming an unlawful combination.

". . . it may be said that for a trade association to set up and induce the use by its members of a scientific and accurate plan of cost accounting is not only legal but highly beneficial to the individual members of the association. The use of this legal and highly beneficial information by each individual in establishing his own production cost and determining his own margin, is entirely proper. If thereafter the association attempts to induce its members to disregard their own varying figures and use a common average or uniform figure of cost or magin or both, it has departed from its proper position of instructor and may easily take on the appearance of a price-fixing combination in restraint of trade or in suppression of competition.

"How far the association can lawfully go in acting as the medium of exchange of cost data among its members can only be determined after the decision by the United States Supreme Court in the pending action against the American Column and Lumber Co. et al, in which this question is involved."

Structural Properties of Metals and Alloys

Applicability of Metals—Factors of Strength and Elasticity—Compression—Ductile and Brittle Materials—Fatigue—Thermal, Magnetic and Optical Properties—Corrosion

By R. W. WOODWARD
Physicist, Metallurgy Division, National Bureau of Standards, Washington, D. C.

FROM the standpoints of the machine user and the machine designer, the important properties of metals and alloys are those which will affect their applicability for structural purposes, for wearing surfaces, for cutting or forming tools and their machinability and adaptability to any of these uses. It is just as important that we know the structural properties of the cast iron in the bed of a planer as those of the alloy-steel crankshaft for the high-speed aviation engine; and it is especially necessary to know why the two materials cannot be used interchangeably. Similarly the properties that make a babbitt metal desirable for a roll-neck bearing would neither be required nor admissible for the shoes of a caterpillar tractor or for the piston packing rings in a locomotive cylinder. The hardened steel of a die would not have the flexibility demanded of a bandsaw, and so on. Yet between all these extremes and from one class to another we have gradation and combinations of the various properties which admit of and require care in the proper selection of a metal or alloy for any particular use. Besides having the desired properties as required by its service, the material must also be capable of being readily manipulated in the shop at a minimum of cost.

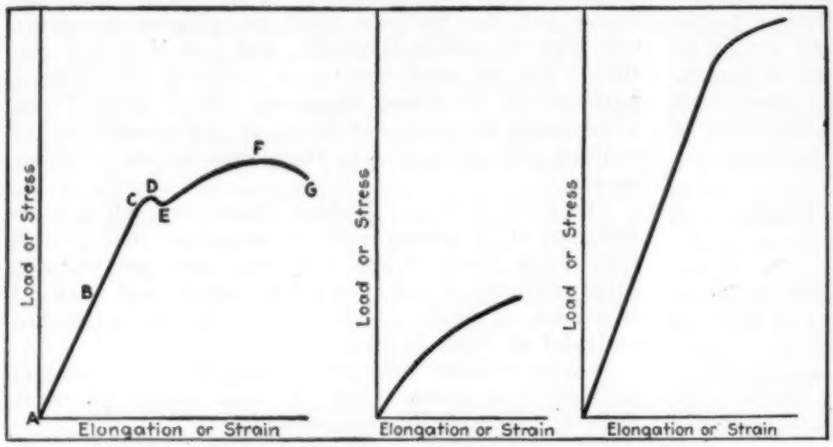


FIG. 1 FIG. 3 FIG. 4

FIG. 1. STRESS STRAIN CURVE OF A DUCTILE MATERIAL UNDER TENSION. (THIS CURVE IS DIAGRAMMATICAL ONLY AND IS NOT DRAWN TO SCALE.) FIG. 3. STRESS STRAIN CURVE OF A BRITTLE MATERIAL UNDER TENSION. FIG. 4. TYPICAL STRESS STRAIN CURVE OF AN ALLOY STEEL

In this paper an attempt has been made to point out some of the underlying points in the properties of metals and alloys and to interest the reader into seeking further information regarding the materials he is accustomed to handle. By no means have all the properties been touched upon, but only those in which it was thought the machinist would be interested. The appended table gives typical values that may be obtained for certain of the properties of representative metals and alloys and shows the wide variations possible in a given property. All the properties of metals and alloys are so influenced by secondary conditions such as composition, presence of impurities, mechanical and heat-treatment, etc., that these values must be considered as representative only and not adapted for design purposes.

The structural properties are probably given first consideration in most selections of material for a given purpose and will accordingly be discussed first in this paper. The engineer interprets the behavior of a structure from the mechanical properties of its component parts and among the properties that are considered are tensile strength, compressive strength, torsional strength, shearing strength and the elastic factors accompanying all of these: ductility; hardness; brittleness; and resistance to fatigue. Of those enumerated, tensile strength is by far the most important and best understood.

Practically all structures are subject to tension or a tendency to be pulled apart, which might be illustrated by the condition existing in a steel wire fastened at one end and from the other end of which is suspended a heavy weight. If the weight be gradually increased, a point will be reached at which the wire will no longer be able to support the load and will break. The total load carried by the wire just before rupture, divided by the cross-sectional area of the wire, is known as the tensile strength of the material. Obviously in a structure we cannot allow the various parts to be subject to stresses that would even approach the tensile strength of the material; therefore a "factor of safety" is applied by which the designed stresses are made a given fraction of the tensile strength such as one-fourth, one-fifth, one-tenth, etc., as the circumstances may be. There are also other reasons for introducing such a "factor of safety" which will be brought out later.

The illustration given above can be likened in a crude manner to the methods used in the testing laboratory for determining the tensile strength of a metal. In the latter case a relatively short length of the material is gripped in the jaws of the testing machine and pulled apart by a load applied by a lever system or other mechanical device for securing large loads. Let us now examine what is taking place in the specimen as it is being broken. Suppose the material is a piece of wrought iron, which we generally consider as being a soft material, and suppose that measurements of the elongation of the iron are taken as the load is gradually applied. If these measurements are then plotted graphically as shown in Fig. 1, we will observe that the first portion of the graph consists of a straight line *ABC*. If the load were only taken up to *B* and then again released, the specimen would return to its original length at *A*. Similarly, if the load were carried up to *C* the iron would likewise return to *A* upon release,

acting through the range *ABC* exactly like a rubber band when stretched and then released. If, however, the load is taken up to *D* and then released we will find that the length will not return exactly to *A* but will have a small permanent set showing that the limit of elasticity of the iron has been reached. Further stretching of the specimen will be accompanied by a small decrease in load at *E* after which the load will increase with considerable elongation to a maximum at *F*, again decrease and the specimen will finally break at *G*. The points on the curve all have a special significance in defining the tensile properties of the iron. Thus the range *ABC* is the elastic range of the material within which the elongation is directly proportional to the applied load. From the slope of the line *ABC* is determined the modulus of elasticity, a quantity which would be useful in calculating, for instance, the deflection of a girder under a given load. The stress at point *C* where the elongation ceases to be directly proportional to the load is called the "proportional limit." The stress at *D* where a marked elongation has taken place without increasing load is the "yield point." The "elastic limit" is the stress at which the initial permanent set of the material is observed and accordingly does not appear on a curve such as shown in Fig. 1, although in value it would be somewhere between *C* and *D*. In order to determine the elastic limit it would be necessary to release the load after each increase in order to ascertain if permanent set had taken place. Because of this extra work involved, the elastic limit is rarely determined in ordinary testing. In fact, there is a large amount of confusion in the use of the term

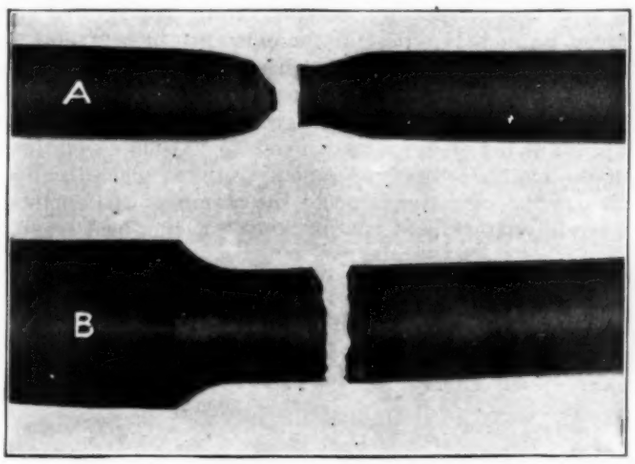


FIG. 2. TYPICAL FRACTURE FOR DUCTILE MATERIAL "A" AND FOR BRITTLE MATERIAL "B"

"elastic limit" by both engineers and users of material; it is used in some cases where yield point is meant and and in other cases where proportional limit would be the proper term.

The stress at the highest point of the curve *F* is the tensile strength of the iron and the elongation at *G* expressed as a percentage of the original length is the "percentage elongation." If the broken specimen is examined it will be found to have drawn out before breaking, assuming a shape similar to the neck of a bottle, as shown in Fig. 2. The ratio of the difference between the original cross-section and the reduced cross-section to the original cross-section is the "reduction in area" of the material. It will be noticed that the last-named properties are essentially a measure of the ability of the material to be drawn out into a wire or of its ductility.

The above description may be taken as typical of what happens when any ductile material is broken; considerable stretch occurs before the metal ultimately breaks. In this class of ductile materials may be mentioned wrought iron, mild steels, many brasses and bronzes, copper, tin, zinc, lead and most of the pure metals. Suppose, however, that we are testing a brittle material or one which will stretch little if any, before it breaks. Cast iron is a good illustration of such a metal and the stress-strain curve obtained by testing cast iron in tension may be illustrated by Fig. 3. Here it is seen that there are no sharp breaks in the curve as was the case for wrought iron. The curve has no straight portion at the start and consequently cast iron can not be said to have a constant modulus of elasticity. Likewise, if the load is released at any time before fracture it will be found that permanent set has taken place, or there is also no "elastic limit." The lack of elastic properties is a fundamental reason why cast iron is seldom used where it would be subject to tension stresses of any magnitude. If the broken test pieces are examined it will be found that the "reduction of area" and "elongation" are practically negligible and only barely measurable, which is further evidence of brittleness.

Brittle Metals and Alloys

While all brittle metals and alloys, such as cast iron, severely quenched steel, certain brasses and bronzes, and many other non-important alloys, exhibit the sharp fracture without any ductility, not all of them are without elastic properties in the sense that they have not a constant modulus of elasticity. The hardest quenched steel, for instance, will, if the test is properly carried out, show practically a straight line stress-strain curve from no load to fracture; in such a case there is, strictly speaking, no proportional limit, elastic limit or yield point detected by our present means of measurement, but all of these properties are coincident with the tensile strength.

Conversely not all materials which do not give a constant modulus of elasticity for a portion of the load range, or show permanent sets with even the smallest loads may be considered as brittle materials. Copper and lead, for instance, receive a permanent set from the application of quite small loads although both of these materials are quite ductile. Many of the cast brasses and bronzes also behave in this manner and in order to gain some idea of what "elastic limit" may be considered as a safe value for design purposes it is usual to determine yield point by ascertaining at what load a given elongation such as ½ of one per cent (0.01 in. in 2 in.) has taken place, it having been found by experience that such a value approximates the useful load to which the material may be subjected or a point beyond which further elongation would rapidly increase with only small additions of load.

Between all the extreme cases enumerated above we find numerous examples of materials having intermediate properties. Thus the alloy steels when properly heat-treated have high tensile strength accompanied by considerable ductility, although there is no well defined yield point found on the stress-strain curve as in the case of the truly ductile materials. This is illustrated in Fig. 4.

A knowledge of the compressive properties of metals is quite important for designing structures that carry

dead loads such as foundations or columns and also for bearings although in the latter case many other factors must also be considered.

The compressive properties of metals include much the same factors as the tensile properties except that the stresses are such as to tend to compress the material rather than to pull it apart. The elastic properties exist under compression and may be determined from the stress-strain curves. The maximum strength under compression, however, is generally not a definite quantity but will vary for the same material for various shapes of test pieces. For instance, if we submit a cube of a soft material such as lead to gradually increasing compression, it will be noticed that the specimen will keep on flattening out as the load increases and no maximum load will be reached. If, however, the specimen were in the shape of a cylinder of length about ten times the diameter, the load will rise gradually to a maximum point but the bar will finally buckle and give way under the load. Brittle materials such as cast iron have a more definite maximum strength under compression and will break into pieces when this limit is reached. Under compression, cast iron also gives a straight line for a portion of the stress-strain curve in distinction to the continuously curved line obtained in tension. Other metals having properties intermediate between the very soft and the very brittle will ultimately fail also, provided the dimensions of the test specimens are properly chosen, by slipping apart on a plane at 45 deg. to the line of application of the load, the final failure being due to a shearing stress.

The percentage of deformation at the maximum strength (corresponding to the "elongation" in tensile tests) may also be determined in some cases although, as can be readily appreciated, no quantity corresponding to "reduction of area" may be measured.

Resistance to Shearing and Twisting

When the application of a load tends to force two adjacent parts of a structure to slip past each other, shearing stresses are developed and a knowledge of the properties of metals under such conditions is necessary in the design of many riveted joints, the design of keys to be set in shafting, or in calculating the power required to punch holes into plates, etc. The elastic properties also exist under shear, and accordingly a modulus of elasticity in shear, or more simply a shear modulus, may be determined.

If a bar is twisted at one end about its own axis while fixed at the other end, so-called "torsional" stresses are set up within the bar, although, strictly speaking, the stresses may be resolved into shearing stresses. A lineshaft or the crankshaft of an engine, in fact practically all shaftings, are subject to torsion and must be built to resist such action. The deformations in this case are measured in terms of the angle of twist or rotation of the material and the usual elastic properties may be considered.

Fatigue Failures of Metals

In all that has been said above regarding the fundamental mechanical properties of metals, it has been implied that rupture of the metal would not take place until the maximum strength of the material had been reached. Unfortunately such is not the case and it has been found that all metals will fail at loads less than the maximum strength (and greater than certain lower limits) provided this load is alternately applied and removed a sufficient number of times. The nearer the applied load is to the tensile strength, the smaller will be the number of alternations required to produce failure; while with lower loads, nearer to the elastic limit, a great number of cycles will be required.

This phenomenon is known as "fatigue," since the metal becomes exhausted and is unable to resist the continued application of the same loads. Its importance in certain forms of structures, particularly where there is vibration or rotation, may be readily appreciated and forms an added excuse for the existance of a "factor of safety" or "factor of ignorance" as it has also been termed. Consider an automobile which is run two hours each day at an average engine speed of 1,000 r.p.m.; at the end of a year about 45,000,000 revolutions of the engine crankshaft will have taken place in addition to the vibrations due to the action of the springs. Certain materials, such as some of the heat-treated

SOME PROPERTIES OF VARIOUS METALS AND ALLOYS*

Material	Tensile Strength, Lb./Sq.In.	Elongation, in 2 In., per Cent	Modulus of Elasticity, Lb./Sq.In.	Compressive Strength, Lb./Sq.In.	Brinell Hardness Numeral	Density Lb. per Cu.Ft.	Melting Point, Deg.F.	Coef. of Linear Expansion Deg. F.	Resistance Ohms/Circular Mil-Foot	Temp. Coef. of Resistance per Deg. F.
Cast iron	30,000	None	15,000,000	100,000	100	450	2,000	0.0000068	.....	.....
Wrought iron	50,000	35	25,000,000	30,800	125	480	2,780	0.0000066	60	0.00322
Low carbon steel, annealed	60,000	35	30,000,000	40,000	...	490				
Low carbon steel, cold rolled	80,000	20	30,000,000	60,000	...	490			95	0.00183
Med. carbon steel, annealed	80,000	28	30,000,000	50,000	135	490	About	About		
Med. carbon steel, heat-treated	125,000	13	30,000,000	100,000	300	490	2,500	0.0000067		
High carbon steel, annealed	86,000	33	30,000,000	.....	156	490				
High carbon steel, heat treated	200,000	10	30,000,000	.....	375	490				
Alloy steel, heat treated	225,000	10	30,000,000	200,000	410	490				
Copper	35,000	50	17,000,000	.....	42	555	1,981	0.0000095	10.37	0.00022
Cast red brass	30,000	22	13,000,000	30,000	40	535	....	0.0000105	39.5	0.00055
Cast gun metal or gov't bronze	38,000	25	13,000,000	.....	64	545	....	.....	.....	.....
Manganese bronze, rolled	75,000	25	16,000,000	.....	100	525	....	.....	.....	.....
Zinc	12,000	..	11,000,000	25,000	48	445	786	0.0000163	36.5	0.00210
Aluminum	13,000	25	10,000,000	67,000	25	165	1,218	0.0000130	16.98	0.00216
No. 12 aluminum cast alloy	20,000	3	10,000,000	.....	55	176	....	.....	.....	.....
Duralumin, rolled and heat treated	55,000	25	10,000,000	.....	...	175	1,200	.....	28.9	.....
Tin	4,000	35	4,000,000	6,400	14	455	450	0.0000126	67.9	0.00240
Lead	2,000	..	700,000	.....	...	710	621	0.0000164	125.0	0.00217
Genuine Babbitt	.....	..	.....	15,000	25	460	460	.....	.....	.....
Platinum	35,000	50	23,000,000	.....	...	1,340	3,191	0.0000050	66.0	0.00204
Gold	30,000	25	.....	.....	...	1,200	1,945	0.0000081	14.5	0.00206
Silver	45,000	..	9,000,000	.....	...	650	1,765	0.0000108	9.9	0.00222
Nickel	40,000	10	29,000,000	.....	76	570	2,646	0.0000071	64.0	0.00230
Nichrome	150,000	..	.....	.....	...	517	2,800	0.0000091	657.0	0.00024
Manganin	.....	..	.....	.....	...	....	....	.....	260.0	0.000006
Constantan	120,000	..	.....	.....	...	554	2,300	0.0000080	293.0	0.00001

* These values are typical only and must not be used for design purposes.

TABLE I—SOME PROPERTIES OF VARIOUS METALS AND ALLOYS

alloy steels, resist fatigue better than other materials and hence are always used where a large number of repetitions of stress are likely to occur. When a metal fails from fatigue, the fracture generally occurs without accompanying elongation or ductility as in the case of a fracture occurring under a static load.

Other Mechanical Properties

Another type of load application that causes failure at stresses below the breaking strength is a suddenly applied one or an impact blow. Metals are subject to examination under such conditions but no new fundamental properties are determined in these cases. Mention has already been made of such terms as ductility, brittleness, hardness, etc. These properties are closely interrelated and, although important, are difficult of exact measurement.

Hardness is used in many different senses, each of which requires a different mode of determination. A gage block is required to be hard in the sense that it will resist abrasion or wear and resulting change in dimensions. This type of hardness is practically not determinable and other means of classification are used.

The Brinell hardness method measures the resistance to indentation and is also roughly proportional to the tensile strength of a metal. The scleroscope is used considerably for measuring hardness, but its readings are also influenced by the elasticity of the material, as will be appreciated by trying it on a piece of rubber, the reading obtained being comparable to that on a sample of hardened steel.

Another form of hardness is resistance to scratching. Instruments have been devised for measuring this property but so far they have not been widely used in testing metals. The file test, which is an excellent and sensitive, though crude test in the hands of an experienced mechanic, is probably a measure of a combination of the scratch hardness and the abrasive hardness. There are also magnetic tests for hardness which, however, are still in the development stage and applicable to limited material, but which show great promise for the future. These various methods of classifying hardness will not always place a series of metals or alloys in the same order. For example, manganese steel such as is used for crusher jaws, railway frogs, safes, etc., is extremely resistant to wear or to cutting tools, yet is quite soft as measured by the Brinell method for hardness.

Brittleness is generally associated with hardness, although not always so; it is the tendency to break under suddenly applied loads or to break without appreciable deformation. Toughness is practically the opposite of brittleness, as a tough material is capable of withstanding shock. The two properties may be combined as in case hardened steel which has a hard brittle shell, generally for the purpose of resisting wear, and a soft tough core to furnish the necessary resistance to suddenly applied loads.

Malleability is that property of a material which permits it to be readily rolled, hammered or pressed into various shapes. Malleability generally increases with rising temperature and advantage is taken of this fact in drop forging and in the rolling of metals into various shapes. Some alloys, as for instance some of the brasses, become brittle at elevated temperature and lose their malleability; they must, therefore, be worked at ordinary temperatures.

Ductility is closely allied to malleability; this being the quality which allows a metal to be drawn out into a wire or into cup-shaped articles such as cartridge cases. It can readily be seen that the elongation and reduction of area measured in a tensile test are a measure of ductility.

(To be Continued)

Brazilian Sales Methods of British Equipment Manufacturers

British manufacturers of automotive equipment are specializing on the South American markets for the sale of motor-car and motor-cycle accessories and spare parts for the better known and most popular makes of American cars and trucks, as well as the sale of service machinery to agents of American automotive products by means of illustrated catalogs printed in Portuguese and Spanish.

These catalogs are distributed in the following manner: A letter is prepared and mailed direct from the manufacturer to a list of service stations, motor-car agents, and distributing houses, with an introduction stating that their name has been given to the manufacturer by a well-known business concern located in the Brazilian markets with whom these various concerns are now doing business, or whose standing is known to them. Special emphasis is laid on the bunching of orders with a quantity discount and attractive long-time terms. These orders, when received, are booked through the central distributing agent, which is the firm which has recommended these names, and a discount of 2½ per cent is allowed on sight-draft remittances. Should prospective buyers have buying agents in London a discount of 3¾ per cent is made for cash in London.

This attempt on the part of British manufacturers of service machinery to compete with similar American products, which have been supreme for some years in practically all the world's markets, is an indication that these manufacturers are studying their problems and have found that they must emphasize the importance of service stations and equipment as a means of furthering the sale of their products in export markets. It has been stated that this method of direct letters to the trade has been the means of placing considerable business with British firms who are not even represented in the market by resident salesmen, and it is herewith published for the suggestion it may carry to American manufacturers.

Metal Cutting Tools—XVI

By A. L. DE LEEUW

(Continued from last week's issue.)

IN ORDER that a proper thread shall be produced it is necessary to have the tool cut along the entire side of the thread for finish. The first full thread of the tap does this finishing, provided that metal is left in the hole. In any case no thread, after the first full thread, can do any cutting except when the lead of the tap is irregular. If, for instance, an 8-pitch thread is cut with the taper part of the tap, and if then the lead should become somewhat more or less than 8-pitch, there will be a slight amount of cutting done even after the full depth of thread has been cut. All such errors in the tap tend to make the groove of the thread *too wide;* in other words there will be a loose fit between screw and nut. As a matter of fact, small irregularities will be found in any commercial tap and we might expect looseness between any screw and its tapped hole, if it were not for the fact that screws also have their imperfections, so that we often find a tight fit, notwithstanding that the tapped hole is too big.

When we said that a tap is merely a screw with some axial grooves milled in, so as to produce cutting edges, we ignored the fact that such a contrivance would not be a true cutting tool, because it would have no clearance. Nevertheless, many taps are made in just that way. A tap made in that way has a strong tendency to bind in the hole and is very apt to break. As a rule, however, taps are not held rigidly in the

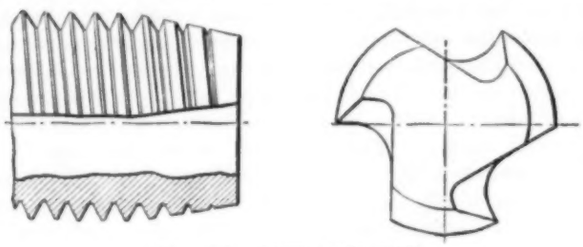


FIG. 269. THE GUN TAP

machine spindle; they have a chance to move sideways so that first one side and then another cuts more heavily clearing the succeeding threads in this manner. As a result it will be found in practice that only one turn of the thread, or at the most two turns, bind in the hole. This binding prevents us from using the cutting speeds which we use for other operations, such as turning, drilling or boring. A tapping speed of 30 ft. per minute is about the best we can expect whereas we use 70 to 100 ft. for other operations. The lack of clearance which can be tolerated to a certain extent for the smaller taps is not permissible at all when the tap is of larger size. In such cases (and, for that matter, even with smaller taps for more refined work) the threads are backed off, thus producing the same effect as we noticed on formed milling cutters.

The V-type taps do not need much cam in order to give an appreciable amount of clearance, due to the large angle of slope of the sides of the thread; the Acme type taps require more cam in order to get sufficient clearance on the side, while a square-thread tap cannot be backed off so as to get any clearance on the sides; at least not if we wish to preserve size and shape of thread; the clearance must be confined to the top.

Of course, a backed-off tap loses its size after sharpening and must be discarded when dull if a fair accuracy of threaded hole is required. This being the case, it is not necessary to give the tap the same kind of relief as a formed cutter. A cutter is made so that

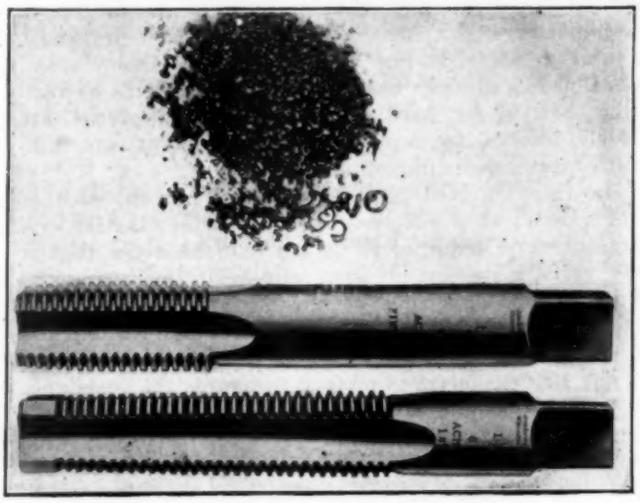


FIG. 270. BATH FINISHING TAP

the tooth retains its size and shape after grinding, and the loss of the size of the cutter is of no importance. With a tap, on the other hand, size is all-important. No matter in what way we give clearance, the tap is bound to lose its size if we sharpen it, so that we may just as well use the easiest method we know to produce clearance and this is the backing-off method.

When we say that we must discard a tap when it loses its size we do not mean that a tap cannot be sharpened at all. As we know, the taper end of the tap does all the cutting while the straight part acts as guide or lead screw. It follows that the straight part will wear but very slowly and that it will be possible to grind the taper part so long as the lead-screw portion of the tap retains its size. When that point is worn beyond the permissible limits of accuracy the tap must be taken out of service.

A tap is not only a poor cutting tool because it has, as a rule, no clearance, but also because it has no rake. The torque required to turn the tap is out of all pro-

FIG. 271. TAP WITH PILOT

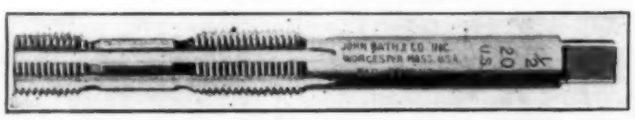


FIG. 272. TAP WITH PILOT AND REAMER

portion to the amount of metal to be removed, which is to be expected where there is no rake. A recent development, the Gun tap, made by the Greenfield Tap &

Die Corporation, overcomes this objection and, as a result, removes metal with much reduced power consumption. This means not merely a saving in power which, as a rule, is of minor importance in machine operations, but it means reduced torque and consequent breakage of taps; it also means increased permissible speed. The chips come out as regular boring chips and, as a result, there is much less tearing of the thread. Fig. 269 shows two views of a Gun tap showing clearly how the rake is obtained and the further general features of construction.

Another recent development is a tap brought out by John Bath & Co. This tap, Fig 270, more particularly intended for finishing, has the threads ground on the sides and in such a manner that only one side of a cutting tooth cuts. If the right side of the first cutting tooth does the cutting, then the left side of the second cutting tooth will be active, and so on. This does away with one of the worst difficulties encountered in tapping, namely, the tearing of the thread due to sticking of the chip. With the arrangement of the Bath tap a cut is taken on one side only, the chip curves up and releases itself readily from the material. As a result, there is no tendency to bind and the tapped hole will have the same size as the tap used. This development is really an outcome of the development of a grinding machine by the same company. This machine is capable of grinding the taps in the manner described above.

For further accuracy John Bath & Co. makes a tap as shown in Fig. 271, which is used as finishing tap only and can be used only for through holes. The tap is provided with a pilot or lead screw at the front end, which is ground a few thousandths smaller than the finished size and will guide the tap in its operations accurately and relieve the finishing tap from the necessity of maintaining lead. Ordinarily, when a finishing tap is introduced in the hole a certain amount of end pressure must be exerted to start the cut, and unless the end pressure is exactly sufficient for this purpose there will be a tendency to change the lead. The tap illustrated here avoids the necessity of introducing end pressure.

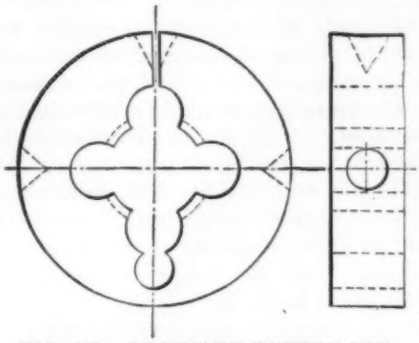


FIG. 273. ORDINARY BUTTON DIE

A further refinement is shown in Fig 272, which shows a tap with pilot and reamer especially for the purpose of removing burrs and bringing the inside diameter to very accurate size. The two developments, gun tap and Bath tap, are really the first striking improvements in taps which have been made for many years. They show a tendency to analyze the action of the tap and meet its requirements.

When large holes must be provided with an accurate thread it is good practice to chase the hole within a few thousandths of finish size and then run a finishing tap through. Such sizing taps do not need a taper portion as leading end, provided that only a small amount of metal is left to be removed. The system of grinding alternate teeth on opposite sides would be particularly helpful in such cases.

There are a great many kinds of commercial taps in existence and it is not the purpose of this article to describe all these varieties as they may be found in any complete catalog. However, we wish to call attention to the pipe tap which differs essentially from the straight tap in this particular: That all the threads of the tap come in action as cutting tools. This divides the cut to be taken over a large number of cutting points, so that the pressure exerted on a single point is small. At the same time the total surface in action is very

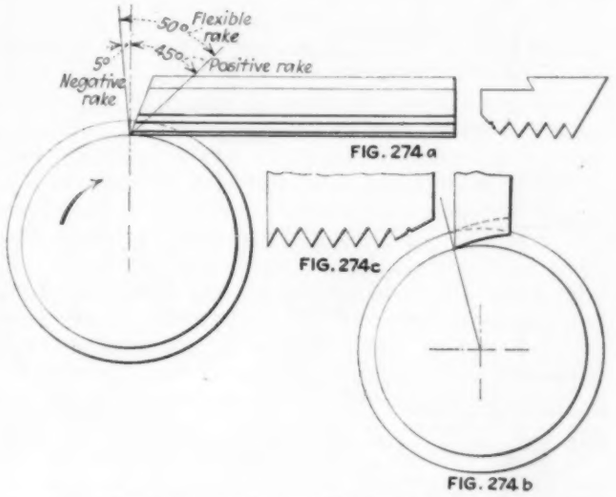


FIG. 274. TWO TYPES OF CHASERS

large, and for that reason a pipe tap requires a much larger torque to twist it into the hole than the straight tap. One will find quite often in description of drilling machines that its power, or rather, torque, is expressed by a statement as to the size of pipe tap such a drilling machine will pull in cast iron or steel.

Dies

As a tap is a modified screw, so is a die a modified nut. For very small screws dies are often made without any attempt at clearance or rake. For larger screws, that is, where heavier cuts must be taken, the teeth of the die are relieved. Fig. 273 shows a button die. It is practically nothing but a nut, part of which has been cut away for the double purpose of providing cutting teeth and chip clearance. The front or entering part of the die has been tapered down for the same purpose for which the tap was tapered. If a full thread

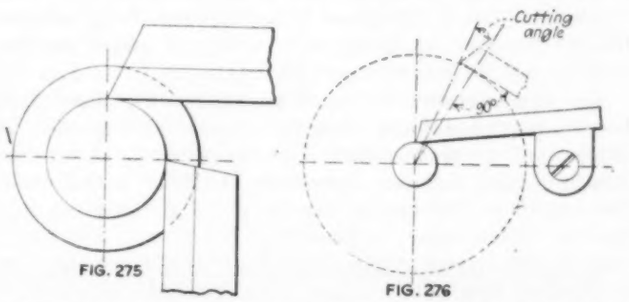


FIG. 275. DIAGRAM TO SHOW WHY CORRECTION MUST BE MADE WHEN USING CHASER. FIG. 276. EFFECT OF DIFFERENT DIAMETERS

has to be cut close to a shoulder the taper part of the die must necessarily either partly or entirely disappear. Where threads have to be cut with fair finish and

close to a shoulder, it becomes necessary to run two dies over the work, one with a certain amount of taper for the roughing cut, the other without taper for finish. Sometimes little or no taper is allowed and the same die used twice, first for roughing, then, after proper adjustment, for finishing. This is common practice with self-opening dies.

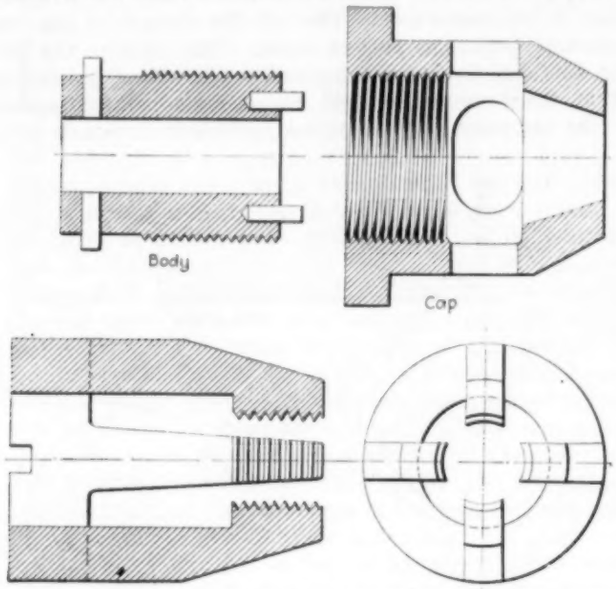


FIG. 277. ACORN DIE OF GREENFIELD TAP AND DIE CORPORATION

To understand the action of a die better, it is well to look first at those dies where chasers are used. A chaser is merely the cutting part of a die which is being held in a fixture or holder. Properties of the chaser determine the action of the die. In order to get a well-finished thread of accurate shape, the chaser must have the necessary rake and clearance angles, the proper lead, and its teeth must be of the proper shape. In Fig. 274a and 274b are shown two different kinds of chasers, both of which are commonly used in built-up dies. The chaser shown in 274b is what is called a hobbed chaser. The sketch shows clearly how the thread is cut in such a way as to provide clearance and rake if the chaser is set in the proper relation to the work. Fig. 274c shows how the tool is tapered away so as to divide up the cut. When the cutting teeth have dulled, the taper is ground further back so as to provide new teeth for the heavy work. There must always be several teeth left to act as guide or lead screw; so that a chaser of this kind can be ground a limited number of times only before it must be discarded, just as was the case with taps.

The chaser shown in Fig. 274a, on the other hand, can be made of indefinite length. Considerations of the amount of room allowable for the die may limit the length of such a chaser, but where the room is unlimited the length of the chaser can be made as great as one desires. This chaser is ground at the front. The taper part of the chaser exists along its entire front, so that no matter how many times it is ground the relation between roughing and finishing part, or one might say between cutting and lead part, remains unchanged. From the standpoint of wear this chaser has many advantages over the one shown in Fig. 274b.

It will be noticed that in both 274a and 274b the normal section of the chaser is not the same as the normal section of the thread to be cut; so that, in order to obtain a theoretically correct thread, the necessary corrections would have to be made in the chaser. As a rule, this is not done, because the threads to be cut with such dies very seldom require a high degree of accuracy. For instance, the chaser shown in Fig. 274a is made by the Landis Machine Co. for the purpose of cutting threads on bolts, pipes, etc. Such work does not require a degree of refinement which these chasers would not give. Where a really first-class thread must be cut it should be the practice to follow the die operations with a chasing operation on the lathe. Fig. 275 shows in an exaggerated form why it is necessary to make a correction when using such a chaser, and Fig. 276 shows, again in exaggerated form, why such a chaser when correct for a certain diameter is no longer correct when adjusted for another diameter. The illustration shows clearly how the adjustment from a small to a large diameter has increased the rake and caused negative clearance.

Button dies of the adjustable type permit a small amount of adjustments for diameter. Self-opening dies permit of a much larger adjustment, and besides, this amount of adjustment can be still further increased by using new chasers, whereas a die of the Landis type permits of a very large amount of adjustment with the same set of chasers. It is well to remember, however, that whenever an adjustment is made, using the same chasers, some error must creep in, and the shopman should keep this in mind whenever he has a job requiring great accuracy.

A button die which will give a greater amount of adjustment and permits of the sharpening of the cutting points without increasing the length of the advance taper is the Acorn die, manufactured by the Greenfield Tap and Die Corporation. This die is illustrated in Fig. 277. The illustration shows clearly how it is possible to grind this die on the side, and the holder illustrated in Fig. 278 is so constructed that it can take care of considerable variation of diameter. Once more we wish to point out that, although all these dies have great practical value, yet none of them will produce a theoretically correct thread except in one position and for one diameter, and only then when the die has been properly corrected for shape of thread.

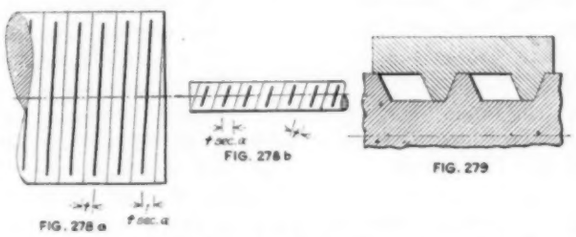


FIG. 278. WHY THREAD MILLING IS INFERIOR TO CHASING. FIG. 279. EXAGGERATED EFFECT OF TOO THIN A THREAD

THREAD MILLING CUTTERS

The thread milling cutter does not differ in any essential from other milling cutters. That it cuts screws is due to the arrangement of the machine in which it is used. All that is required of the cutter itself is that it shall have the proper section for the thread to be cut. If a milling cutter were made of such a correct section and if it were set in the machine in

the proper position, it would cut a theoretically correct thread, except if it were required to cut a square thread. Square threads cannot be milled, because there would be interference between the cutter and the work. If the cutter could be made small enough, any thread except square thread could be milled. In other words, it would be possible to mill a thread with an angle of one degree or even less. However, this would require a very small cutter, too small for practical purposes. It is now common practice to use threads with small angles on the sides where formerly square threads were used. Whenever the shopman is confronted with the milling of such steep-sided threads, he should carefully look into the matter and see whether there is danger of interference. The presence or absence of such interference depends on the diameter of the cutter, the diameter of the work, the depth of the cut, and the angle of the sides of the thread. Such interference does not occur with Acme or V-type threads.

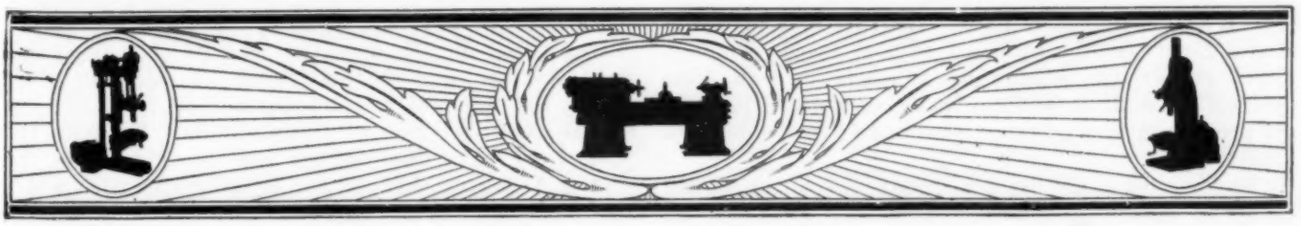
It is a popular belief that the method of milling produces a superior thread. If this is true at all it is so, not on account of any essential merits of the system of milling, but on account of the fact that thread milling machines are precision machines and that the accuracy of pitch or lead does not depend on the tool used but on the accuracy of the machine. Outside of this superior accuracy of lead, the method of milling does not offer any advantages which cannot, in some way or other, be had with other methods, and unless the cutter is properly designed for the thread to be milled, this method is inferior to chasing on an accurate lathe. The reason is indicated in sketches 278a and 278b. Both figures represent a thread cut with the same cutter and, of course, of the same pitch; but the diameters of the two pieces are widely different and consequently the angle of the spiral of the large piece is much less than that of the small piece. As the cutter is set parallel with the spiral the width of the gap must be the same as the thickness of the cutter, say at the pitch line; in other words, the normal width of gap of both threads is the same. If the angle which the spiral makes with the normal plane of the cylinder is α, then the width of the gap measured axially is $t \sec \alpha$, in which t is the thickness of the cutter at the pitch line. Consequently the piece with the smaller diameter will have a wider gap, measured axially, than the larger piece. The pitch or lead must, of course, be the same, as this pitch is produced by the lead screw of the machine and not by any dimension of the cutter. As for a small diameter of screw, if the gap is too wide it follows that the thread must be too thin. If an internal thread were milled the same way, screw and nut would fit together as shown in Fig. 279 in exaggerated form.

Furthermore, as the cutter is set at an angle with the normal section of the work, we have the same condition as we found to exist when cutting square threads with the tool set at an angle, namely, that neither the sides nor the bottom of the thread will be straight lines. This is of special importance when cutting multiple thread screws or screws with very large lead and deep threads. In such cases it becomes necessary either to have a cutter which is corrected for the special job to be done, or else take a finishing cut with a lathe tool.

The name thread hobbing is not entirely correct. The action is not a generating action but is really the same as thread milling action, the difference consisting merely in the fact that a multiplicity of milling cutters is used. As a rule these milling cutters are not separate tools but are all in one, so that a thread milling hob is merely a milling cutter which would make grooves in a flat piece of metal of the same shape as the contour of the thread to be cut. For a V-type thread a section of the hob would represent a number of V's set side by side with a distance from center to center equal to the pitch of the screw. The process of thread hobbing consists of feeding the hob into the work to the required depth, then turning the work against the cutter and advancing it at the same time so that the advance equals the pitch of the screw for one complete revolution of the work. In practice, the work does not first stand still until the hob has penetrated to the proper depth, but as a matter of fact it rotates all the time. Neither is it essential that the work feed forward while it turns; the hob might advance while the work rotates. In short, any mechanical arrangement might be used provided that the result is a screw thread.

The advantages of the hobbing process are obvious. For relatively short screws all threads are milled at once. The teeth of the hob are cut on a cylindrical body and if we should set the hob so that its axis is at right angles to the spiral of the thread to be cut, part of the centerline of the hob would be above, and another part would be below the center of the work, so that some threads would be cut to a larger diameter than they should have; in other words, the threads of the work would be cut on a hyperboloid and not on a cylindrical body. For this reason the hob is set with its axis parallel to the axis of the work. So long as the spiral of the screw to be cut does not make a large angle with the normal section this way of setting the hob leads to no trouble, but where the angle of the spiral is great, interference would take place between hob and work. For this reason the hobbing process lends itself particularly for relatively fine threads.

It must be evident from the foregoing that, with the exception of the single-point tool, all thread cutting tools are in the nature of a compromise. Unless specially made for *one* particular job they produce incorrect threads, in which, however, the inaccuracies are well within the limits of what is permissible in commercial work. When unusual or extremely accurate work must be produced these compromise tools are no longer satisfactory.



MODERN PRODUCTION METHODS

By
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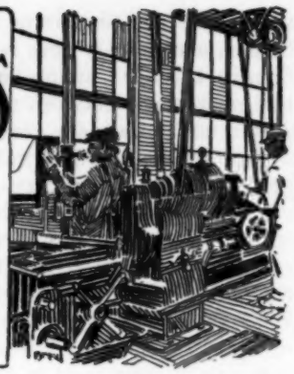


XXIII. Setting the Standard

Records of Actual Time-Studies of Machine Operations—Fallacy of Taking Over-all Times for Standards—Some Special Complications

WHILE it is essential to understand the fundamentals of time-study work which were described in general terms in the preceding article, nothing will give a clear-cut idea of the procedure in setting standards like a minute description of how an actual standard was set.

In Figs. 105 and 106 are shown time studies Nos. 107 and 380, showing the "mill radius" operation on a part we will call *LU75ABR*.

After a few operations had been observed, it was found that the operation could be analyzed into four performances, which with their stopping points are as follows:

Performance No.	Performance	Stopping Point
1	Mount Part	Feed on
2	Cut	Hand to R. S. Crank
3	Lower table	Hand from R. S. Crank
4	Remove part	Hand to new part

This is an example of a short operation for which the analysis can be prepared in advance. Note the use of the standard stopping points "feed on" and "hand to new part." Sufficient parts are in process to permit the use of "discontinuous times." The observations taken on the first operator are shown in study 107, Fig. 105.

Our first point of attack, as we saw in the preceding article, is to check up on the speeds and feeds; therefore we start the standard setting with performance two in which the cutting time is isolated. The stopping point "hand to R. S. Crank" is practically coincidental with the moment of throwing off the feed, and is chosen because it is more striking in this particular operation. The cut took an average of 70⅜ sec. at a spindle speed of 93 r.p.m. (which was a cutting speed of 91 ft. per minute), and a feed of 1.59 in. per minute measured on the table. Investigation showed the speed and feed to be entirely too slow for this operation. It was found that greatest economy called for a spindle speed of 150 r.p.m., giving 147 ft. per minute with the same cutter, and a feed of 2½ in. per minute measured on the table, which would reduce the standard cutting time to 38½ sec.—a saving of nearly half. The fact that the operator did not use the proper feed and speed—while it would render the results of a single over-all time observation entirely without value as a standard—did not prevent setting a proper standard from the detailed time study.

Checking the study for unnecessary steps, the second factor in setting standards, it is evident that they all bore directly upon production, and therefore all of them were included in the standard.

Study of the third factor—the speed of the operator—indicates this man does not work at uniform speed throughout the operation. This is usually true, but this time study shows the point unusually well. Take performance one for instance. Twice the operator succeeded in accomplishing this performance in 8 sec., but above that the time ranges all the way up to 16 sec., just twice as long. Had he worked at a uniform rate throughout each operation, the over-all time on the ninth operation would have been twice the over-all time on the tenth, but this did not prove to be the case, for the over-all times are respectively 103⅜ sec. and 90⅜ sec. Observe the fourth performance on these same two operations. It will be noted that the operator performed them in precisely the same time, which was the minimum time for the fourth performance, notwithstanding that the over-all time for operation nine was the maximum in the series.

The time for performance one varies from 8 to 16 sec. with an average of 10⅜ sec. As the average is 10⅜ sec., with such a variation there would seem to be no reason why we should consider at all the instances in which 16, 11, 14 and 12 sec. are required. The question is—if the average, which includes the abnormally high figures, is only 10⅜ sec., should we, realizing that the workman is only fairly skilled, allow as much as 10⅜ sec. for a standard time to be expected of a 100 per cent workman? When we consider that the operator twice did the performance in 8 sec., did it once in 8⅜ sec., and once in 8⅛ sec., it appears not unreasonable that a skilled operator with a wage incentive should mount his part consistently in 8⅜ sec. This is therefore set as the standard for performance 1.

Using the same method of thought we set the standards for performance 3 at 8 sec. and for performance 4 at 4 seconds.

The standard time for the complete operation is the sum of the standards of the individual performances. It amounts to 59⅜ sec., whereas the average observed over-all time for the operation was 94 sec., the minimum, 85⅜ sec. and the maximum 103⅜ sec. In other words, the standard is but little over half the average and about 70 per cent of the minimum. Yet with the method we have used we are able to affirm with the utmost confidence that 59⅜ sec. is the proper time which this operation should take.

It happened that we had an opportunity to make another study on the same operation with a different operator, the result of which is shown in study 380, Fig. 106. This operator had already chosen the correct speed and feed, identical with that which we developed by proportion from study 107. Here is a striking example of the fallacy of over-all times.

If we had had no other information about the operation than that given by over-all times, we would have concluded that 94 sec., the average of study 107, would have approximated the proper standard; and this conclusion would have been confirmed by the average secured from study 380—94⅔ sec.—almost exactly the same. Analyzed by performances, the observations reveal an entirely different story. They show that, on the cut, study 380 was almost twice as fast as study 107. The almost exact coincidence of the over-all times was due to the fact that, in all parts of the operation except the cut, the operator of study 380 was almost three times as slow as the operator of study 107. They show furthermore that the operator of study 380 included an extra non-productive performance of raising the table between performances one and two, which we have called in study 380 performance 1A, and which since the 107 operator did not use it, is shown to be unnecessary. We have therefore dropped it in computing the standard. The net effect in this case of taking detailed and analyzed observations discloses that even though the two operators on the performance required identical over-all times, both of these times which checked so well are nearly one hundred per cent too high.

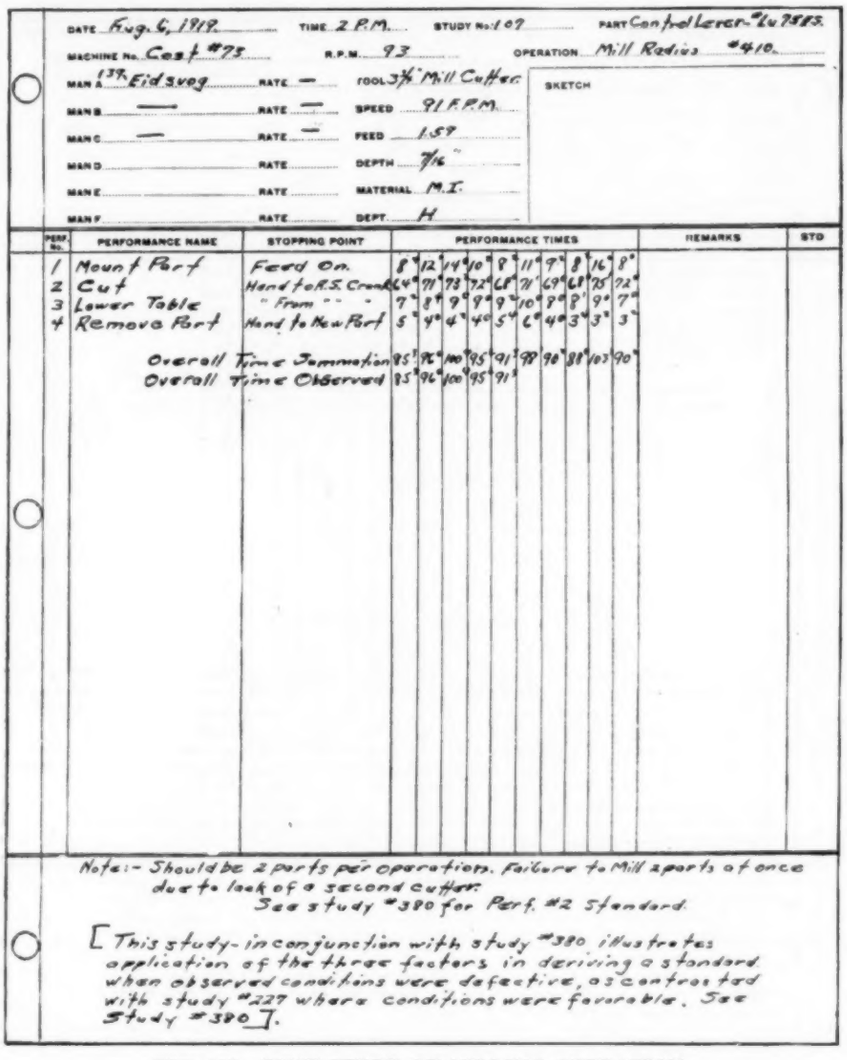
In this instance, we had a problem in standard setting which combined all three of the factors. At the other extreme we have study No. 227, shown in Fig. 107, where the operator was the foreman for the milling department. The operator's skill was great and his disposition to turn out as many parts as he could was rated 100 per cent. Combine this with the fact that the operation was all hand work, and we would expect the over-all times to form a very reliable guide as to what the standard should be. Observe how very nearly this proved to be true. The times for the first performance were remarkably uniform; the minimum is 6 sec.; the maximum, 8 sec.; and the average 7⅜ sec. In five instances a time of 7 sec. flat was repeated, which is a remarkably consistent record. Compare the "mount part" performance with that shown above in study No. 107 and note how the increased skill of the workman gave greater uniformity. It was not thought advisable to expect of any operator a performance more uniform than that of the observed workman. Accordingly the average time was taken as the standard.

In the second performance, the cutting time, a greater variation occurred, and yet the times shown are fairly consistent; that is to say, the average is almost half way between the maximum and the minimum. Observation showed that this variation was caused by variation in the amount of stock to be removed. The standard on this performance was set by eliminating the two maxima and averaging the rest.

Performance three is remarkably consistent in its turn. The time, 6⅜ sec., was repeated five times, but the variation below this average is a little greater than in performance one. Both the third and tenth operations are substantially below the average. It was therefore thought proper to reduce the standard slightly below the average of performance three. The result is a standard of 6⅛ sec. comparing with an average of 6⅜ sec.

When the total standard is computed, it is found to be 30 sec. compared with 30⅜ sec. average. It develops that we would have been justified in using the over-all average of this operator in fixing the standards, but we could not have done so with the same assurance as we are justified in feeling after taking detailed times.

Without actually reproducing the studies, I want to cite some special complications that have arisen in setting other standards. Needless to say, it would be impossible to describe every difficulty and special case


DATE Aug. 6, 1919 TIME 2 P.M. STUDY No. 107 PART Control Lever #4478S.
MACHINE No. Cost #75 R.P.M. 93 OPERATION Mill Radius #410.
MAN A Ed Svog RATE — TOOL 3/4" Mill Cutter
MAN B RATE — SPEED 91 F.P.M.
MAN C RATE — FEED 1.59
MAN D RATE DEPTH 7/16"
MAN E RATE MATERIAL M.I.
MAN F RATE DEPT. H
SKETCH

Perf. No.	Performance Name	Stopping Point	Performance Times										Remarks	Std
1	Mount Part	Feed On.	8"	12"	14"	10"	8"	11"	7"	8"	16"	8"		
2	Cut	Hand to R.S. Crank	64"	71"	78"	72"	68"	71"	69"	68"	75"	72"		
3	Lower Table	" From " "	7"	8"	9"	9"	9"	10"	8"	8"	9"	7"		
4	Remove Part	Hand to New Part	5"	4"	4"	4"	5"	6"	4"	3"	3"	3"		
	Overall Time Summation		85"	76"	100	95"	91"	98"	88"	88"	103"	90"		
	Overall Time Observed		85"	96"	100	95"	91"							

Note:- Should be 2 parts per operation. Failure to Mill 2 parts at once due to lack of a second cutter.
See study #380 for Perf. #2 Standard.

[This study- in conjunction with study #380 illustrates application of the three factors in deriving a standard when observed conditions were defective, as contrasted with study #227 where conditions were favorable. See Study #380.]

FIG. 105. TIME STUDY OF MILLING OPERATION

that the time study man will run into. But perhaps typical instances will indicate the method for the more common problems.

A certain lathe operation consisted in tapering the end of a shaft. The performances as observed were (1) mount new part, (2) set tool, (3) first cut, (4) reset tool; (5) second cut, (5a) reset tool, (5b) third cut, (6) part out and gage, (7) dog off and part aside. Two cuts were all that were needed as shown by the fact that the third cut was omitted by the workman in three out of the ten studies. The foreman and superintendent maintained that a good workman could perform the operation in a single cut. To obtain accuracy of cut we decided to allow two cuts, but to eliminate the third from the standard. The man whom we observed was first-class as to skill, but unsympathetic and anxious to inflate the standards.

Another case was the turning operation on a heavy cast-iron flange which the workman performed in an average of 3,296 sec. In all, there were twenty performances, of which performance (1) was secure new part, (2) insert arbor, (19) remove arbor, (20) move part aside. These four performances took on the average a total of 150 sec. But the total time taken up in cutting while the man was completely idle was on the average 2,300 sec. We supplied him with an extra arbor so that he could perform operations 1 and 2, during the cut on the preceding part and 19 and 20 during the cut on the following part.

After study we set the standard at 2,690 sec., or nearly 20 per cent lower than the old average.

In another study, a wide variation in the non-cutting times was observed. The workman was reasonably skillful, so the variation indicated intentional "soldiering." Experience has shown that no workman can inflate his time consistently. Consistent times, if the method is right, can usually be depended upon to show conscientious effort on the workman's part. In the study under consideration, the times on the "mount part" performance ran, in seconds, 11, 9, 9, 12, 12, 12⅜, 10, 11½, 12 and 11. The minimum time, 9 sec., was taken as the standard. The "part out" performance ranged from 5⅜ to 14⅜ sec. The standard set was again the minimum. Later trial of these standards in the shop failed to show that they were hard to achieve.

I cite these instances not only to illustrate the actual setting of a standard, but also to indicate how the development of standards by time study analysis permits an intelligence higher than that of the ordinary workman to arrive at the proper working time—the time which a 100 per cent workman of the kind assigned to the work could be expected to maintain.

The standard is not an average. The nearest approach to a rule that can be given is that the standard may approximate the average obtained from the observations after the extremes have been eliminated. The proportion of observations to be eliminated as extreme would then depend largely upon the estimated skill of the workman. This calls for considerable judgment. It is not a safe rule to follow even then, for we have just seen that sometimes the standard is brought down to the minimum. Sometimes when the workman's method can be improved, the standard time is made less than the minimum. Perhaps it is better to say that, based upon the observations, the standard is *selected*, keeping in mind the definition of a standard,

DATE Sept. 9. 1918 TIME 11 A.M. STUDY No. 380 PART Control Lever #Lv 7513
MACHINE No. 296 Cost No. 104 R.P.M. 150 OPERATION Mill Radius #H10
MAN A 49- Ralston RATE — TOOL 3¼" Milling Cutter
MAN B — RATE — SPEED 147 R.P.M.
MAN C — RATE — FEED 2 ⅛"
MAN D RATE DEPTH 7/16"
MAN E RATE MATERIAL M.I.
MAN F RATE DEPT. H.
SKETCH

PERF. No.	PERFORMANCE NAME	STOPPING POINT	PERFORMANCE TIMES										REMARKS	STD
1	Mount Part	Hand to R.S. Crank	25"	19"	20"	21"	24"	28"	22"	30"	16"	30"		
1a	Raise Table	Feed On	Time	6"	7"	4"	5"	5"	5"	Time	6"	Time		
2	Cut	Hand to R.S. Crank	44"	45"	35"	38"	37"	36"	39"	42"	43"	42"		
3	Lower Table	"From" " "	16"	10"	13"	18"	17"	16"	19"	21"	17"	11"		
4	Part Out	Hand to New Part	14"	6"	16"	9"	11"	7"	6"	6"	5"	14"		
	Overall Time Summation		100"	88"	92"	91"	95	94"	93"	100"	89"	98"		
	Overall Time Observed		100"	89"	92"	91"	98"	81"	87"	100"	87"	94"		

Note:- Compare Study No. 107. The most striking difference is in cutting time standard for which will be taken from the present study with its increased speed and feed. For the other performances no reason occurs to be given if the lower times of Study #107 and therefore they will be used. The discrepancy can in fact be largely accounted for. Performance #4 time was increased by the operators practice of unscrewing his set screw much further than was necessary this resulted on Perf. #1 & 1a increase. Similarly in Perf. #3, the table was lowered a full inch and a half (15 R.S. Turns) more than was required. Part of this was taken up in Perf. #1 throughout which the feed was on, and remainder resulted in Perf. #1a. which is unnecessary

Note:- When attempt was made to make this rate on the small Kempsmith machine of Study No. 107 it was found that the smaller machine would not take the above speed. Rate is accordingly set in contemplation of the work being assigned to one of the larger machines where it can be done with proper speeds and feeds

Note:- Only lack of a second cutter prevents production of 2 Parts per operation as contemplated by the jig

Setup Rate .09 ¢

[Note:- See note on Study #107]

FIG. 106. SAME OPERATION AS FIG. 105 BUT DIFFERENT OPERATOR

and taking account of the conditions of the study, the skill of the workman, the disposition of the workman, the hardness of the metal and all other relevant data.

Our standards, as so far developed, give the proper amount of time needed for the actual productive processing of a part. I have already mentioned, incidentally, that it is necessary to eliminate from the study and from the standard any items of non-recurring non-productive time. But before we can set a proper rate we must take into account these interruptions. This we do by adding to the standard proper allowances to cover interruptions which may reasonably be expected.

The most common allowances are those for fatigue and tooling. If in addition the operator attends two

machines simultaneously, there may be a justifiable loss due to one of the machines being stopped while he is busy with the other.

The fatigue allowance takes account of the fact that a man cannot be expected to repeat an operation indefinitely at a regular and unvaried rate, as can a machine. There must often be a margin allowed to absorb the slackening of effort, which will represent the operator's reaction from the strain of continuous application. We have already seen that where the cutting time is very long the operator may be expected to recuperate from a considerable strain during the cutting time.

DATE Aug. 25. 1919 TIME 10 A.M. STUDY No. 227 PART # DAF 210
MACHINE No. 242 Cast No. 16 R.P.M. 320 OPERATION Burr # H10
MAN A Jim Curry RATE TOOL Sharp Nose Cutting Tool
MAN B (Foreman) RATE SPEED 198 F.P.M.
MAN C — RATE — FEED Hand
MAN D RATE DEPTH 1/64"
MAN E RATE MATERIAL Steel
MAN F RATE DEPT. H
SKETCH

Perf No.	Performance Name	Stopping Point	Performance Times										Remarks	Std
1	Mount Part	Hand to Feed	7"	8"	7"	6"	7"	7"	7"	7"	8"	8"		
2	Cut	Hand from Feed	16"	14"	14"	17"	14"	28	28	19"	16"	16"		
3	Remove Finished Part	Hand to New Part	6"	6"	5"	6"	6"	6"	6"	6"	7"	5"		
	Overall Time	Summation	30"	28"	26"	29"	27"	38"	39"	33"	32"	30"		
	Overall Time	Observed	30"	38"	31"	32"	32"	-	-	-	-	-		

Note - Parts taken from and returned to pin conveyor to right rear of operator. Very close performance.

Note:- The studies derived from this study will all show the same R.P.M. with proportionate speeds based upon the diameter. Some of these speeds for the higher diametered parts will be entirely too high; but it is not thought worth while to compute what the proper speeds would be inasmuch as the governing factor in the cutting time which is the hand feed can be kept constant on all parts at the rate shown above, and the R.P.M. reduced as indicated for the larger parts.

Set up Rate - .05¢

[Illustrates the following: Minimum number of performances to an analysis; setting standards with expert and well disposed operator; instance where no tool allowance called for]

FIG. 107. TIME STUDY OF EXPERT OPERATOR

Fatigue is a somewhat complex problem. It will vary with the workman's physique, with the size and shape of the parts, with the distance through which they must be moved, with the initial and final positions of the operator in making such movements, with the average activity of the operator, and sometimes with still other factors. Since to determine the effect of fatigue is theoretically so complicated, we resort to empirical rules which experience has proved satisfactory.

The general rule is to add 10 per cent of hand time for fatigue. It is usually the hand time which causes fatigue, machine time having the effect of absorbing the fatigue loss. But if the cutting is done with hand feed it is classed, for the purpose of developing the fatigue allowance, as hand time. The observer will have to use his best judgment in setting the fatigue allowance if the cutting time is very long.

If, however, the work is very heavy, 10 per cent will not sufficiently compensate for fatigue. In some operations, the operator is required to be constantly active. In such operations 20 per cent, or even more, depending upon the strain and effort, may not be too much to allow for fatigue. I want to impress this fact—that the greatest care and good judgment are called for in setting fatigue allowances, for great injustice and physical harm can come from a standard which workmen rightly stigmatize as "killing." No good can come to the employer from such a standard.

The tool allowance is provided to cover time required for minor adjustments of the machines, for grinding tools, changing cutters and the like. Five per cent of the machine time is a fair average for this purpose. Here again the observer must use his judgment. In some milling operations, 1 per cent tool allowance is enough, especially if exactness of cut is sought rather than speed, and the cutters consequently stand up well and can be changed in a comparatively short time. When the tools are cared for in the toolroom and the operator has only to replace them on his machine, 1 per cent is ample. The duration of cuts will also offset the percentage allowed for tooling. When the cut is long the percentage naturally will be less than for a short cut.

Sometimes no tool allowance whatever is given, for the time which may be required in tool adjustment is so slight that it can be included in the fatigue allowance. Setting the tool allowance does not call for the same measure of judgment as does the fatigue allowance, but even so it should not be assigned without due thought.

Tool and fatigue allowance between them must cover the extra cuts and extra measurements which the operator has to take in reasonable proportion. If lack of skill causes an undue number of extra cuts or extra measurements, it is proper that the operator should suffer in decreased earnings.

On simple operations, the set-up time may be no more than that required to bring the tools from the toolcrib. But for a complicated operation on the automatics, it may be quite extended. It is really a separate standard. It is designed to equalize the earning power of the operator in supplement to the piece rates, taking account of the fact that once a set-up is made, any number of parts may be produced from it. It cannot properly be incorporated in the standard for the part it is intended to produce. Furthermore it may be done by a different man.

Three elements make up the set-up time; first, time for taking down the preceding set-up; second, time for the set-up itself; third, time for the extra cuts and

measurements necessary to secure adjustment. The first element is a constant for each class of machines based on the average take-down of jobs on machines of that class. It is obtained by observation. The average must be used because it is impossible to predict for any set-up the job which would precede it, and the only alternative would be to have a take-down rate separate from the set-up rate. The number of set-ups to be made will seldom justify this degree of detail. The second element, the set-up time itself, is standardized from analyzed observation just as are the operations themselves. The adjustment time is most conveniently obtained by subtracting the average of the over-all times on the operation from the observed over-all on the first few parts until adjustment is completed. The complete set-up standard will be the sum of the three elements.

The extent to which detailed set-up times are warranted depends upon the magnitude of the set-up and the frequency with which it recurs.

Wages of Foreign Workers Show Decline

Great rapidity of movement and wide variations locally have characterized the wage changes in Great Britain, France and Germany during and since the war, according to a report issued today by the National Industrial Conference Board. The great number of wage adjustments is the outstanding fact of the material gathered in the board's study. This rapid, almost continuous, change of base was principally due to two factors: (1) The large number of agreements for wage adjustments according to changes in the cost of living, and (2) to the quite general provision that when blanket agreements covering an entire industry existed, local adjustments varying the standard to meet local conditions were permissible. The rapidity and wide variety of changes has characterized the downward as well as the upward movement.

Percentage increases over 1914 wages in the three countries covered varied widely among different groups of workmen. The more highly paid workmen received a relatively small increase, while the lower paid workers received a large increase. Money increases to cover the cost of living were practically the same for all classes of workmen, and the relative increase, therefore, was disproportionate. In Germany especially there has been a tendency for the wages of unskilled workers to approach those of skilled workmen; the former must have a subsistence wage, and employers have been able to pay but a little more than this minimum to skilled workers.

The peak of prices was reached in all three countries at the end of 1920. In Great Britain and France there have followed substantial reductions in wages in most of the industries during the first months of 1921, but in Germany, there was no evidence in wage agreements of reductions in wages, possibly because even with the decrease in prices, the cost of living was still above the wage level.

In Great Britain, according to the report, wages have, in general, followed retail prices so closely that there is little difference in the purchasing power of those wages now as compared with 1914. This is especially true in those industries where the cost-of-living figure is used as a basis for determining wages. Among the more highly paid workmen the increase in wages over those of 1914 amounted up to the end of 1920 to not more than 120 or 130 per cent. Among the lower-paid group of workmen in the same industries the advances were equivalent to 200 per cent or more, and in some instances increases of over 300 per cent over 1914. The average increase in full-time weekly rates of adult workers ranged from 170 to 180 per cent. During this period the length of the nominal work week in Great Britain had been considerably reduced, and owing to the serious decline in employment in the closing months of the year the actual weekly earnings in many industries were considerably lower at the end of 1920 than at the beginning of the year. Reductions in wages, affecting 2,556,000 workers, occurred between January and April, 1921. These reductions fell into the following four classes: (1) Reductions in wages of coal miners in accordance with variations in output of coal; (2) reductions brought about under agreements by which wages vary in accordance with the cost of living figures as determined by the Ministry of Labor. These reductions affect chiefly the railway service, wool manufacturing, textile, dyeing and finishing and the hosiery manufacture; (3) reductions made in accordance with sliding scales based on the selling price of the commodity; (4) agreements resulting from negotiations between employers' associations and trade unions.

The cost of living in France, according to an American official quoted in the report had increased more than 300 per cent by the end of 1920, and wages were lagging behind. The tendency has been to maintain without modification the basic pre-war wage rates and to make necessary increases in the form of bonuses for the high cost of living. The amount of such bonus is fixed, along with wages and other conditions of labor, by collective agreements between employers and employees. In almost all cases extra provision is made for married workers with children.

For Germany no comprehensive figures for the whole country are to be had, but it is estimated that the cost of living has gone up to a greater extent than have wages. A male adult worker in Berlin in November, 1920, is estimated to have received an increase over 1913 in average weekly wages of 700 per cent, while the cost of living in Berlin during the same period had increased 1,100 per cent according to a German authority quoted in the board's report. The average weekly earnings of a man in Berlin in November, 1920, are stated to be about 240 marks, which, according to an average of exchange values of the mark over 1920-1921, is equivalent to about $4.50. A vast system of schedules of wages and salaries has been built up in Germany since the revolution and is now being perfected and adjusted to existing conditions. The tendency more recently has been to fix the wage schedules centrally and to make them applicable to the whole country, adapting them to local requirements and to the constant changing of the cost of living. The number of German wage-earners on a schedule basis is continually increasing.

Automotive Registration in Bangkok

Consul James P. Davis, of Bangkok, Siam, reports that the whole number of automobiles registered in Bangkok in the past twelve years is 1,483, many of which have gone out of service. He states that the present rate of importation into Siam is about 50 per month, most of which are low and medium priced vehicles.

Ideas From Practical Men

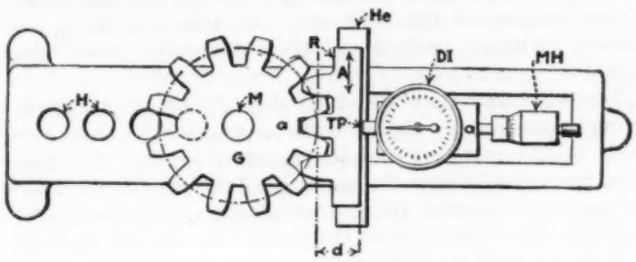
Devoted to the exchange of information on useful methods. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. The articles are made up from letters submitted from all over the world. Descriptions of methods or devices that have proved their value are carefully considered and those published are paid for.

A Device for Inspecting Gears

BY FREDERICK FRANZ

The proper inspection of gears has been difficult and involved because the pitch diameter—the most important practical dimension—is an imaginary line and therefore cannot be measured directly.

An instrument designed by the writer and shown in the illustration herewith may be used for determining



DEVICE FOR INSPECTING GEARS

whether or not the pitch diameter of a gear is within the specified limits and can be used for inspecting gears in small or large quantities.

It does not require the use of standard gears or base-circle disks as do some gear-inspecting devices. The member mating with the gear to be tested is a rack which may be made of steel and hardened and ground with simple appliances, as the sides of theoretically perfect rack teeth are straight lines. The principle employed is that of the generating process. The rack *R* is capable of moving in both directions indicated by the double headed arrow *A*. It is evident that, if the gear *G* to be tested (with which the rack is kept in mesh) has perfect teeth, the rack will move in a straight line in either direction and will have its pitch line the correct distance from the center of the mandrel *M*. The mandrel can be inserted in any one of a series of tapered holes *H* one inch apart for gears of various radii and the rack can be adjusted for the fractional part of an inch by means of the micrometer head *MH* which moves the rack through the medium of a dial indicator *DI*, mounted on a slide. The dial indicator must read zero when the micrometer reads zero; when the distance from the center line of any hole *H* to the testing point *TP* of the dial indicator is a whole number of inches. The adjustment is effected by means of an end measuring bar and, once adjusted, will accurately measure any gear that may be inserted without further adjustment. A different rack *R* is used for each size tooth, but on all racks the distance *d* is exactly 1 in. If it is desired to inspect a gear with a pitch circle of 2⅛-in. radius and 8-diametral pitch, the mandrel is set in the 2-in. hole, the micrometer head is set to 125 thousandths, and the 8-diametral pitch rack is inserted. The gear is then placed on the mandrel *M* and if the diameter of the pitch circle is 2⅛ in. and the gear is correct in all other respects of tooth form and spacing, the dial indicator will point to zero. If it is under or oversize the difference will be indicated on the dial indicator. The gear may now be rotated on its mandrel to the limit of the movement of the rack and the variation of the indicator noted and checked with the tolerance permitted by the blueprint. The indicator will read undersize if all the teeth in contact with the rack are too thin or if the pitch radius is undersize. It will read oversize if the teeth are too thick or if one tooth in contact is too thick, if the teeth are not accurately spaced or if the pitch radius is too large, for then the rack is prevented from sinking as deep as it should into the gear. This instrument will enable an inspector to accept or reject gears as being within the tolerance, but will not indicate tooth profile for the correction of the gear cutter.

The head *He* carrying the rack is mounted so as to rotate 90 deg. on each side of the position shown about the axis *aa*. This permits measuring all helical gears ranging from a spur to a single threaded worm. The head *He* is graduated to read within 5 min. of arc by means of a vernier and is set to the correct helix angle before inspecting gears. The gear is measured in steps, the entire rack being withdrawn from the mating teeth and dropped into the next set to be measured. In the helical gear a lateral sliding exists between the rack and the gear teeth when the gear is being turned.

The Fitting of Babbitt Bearings

BY J. C. NICHOLSON

Much time is wasted in scraping babbitt bearings.

Where heavy duty is demanded and the projected area is close to the allowable limit, there is need for scraping in so far as it helps to secure perfect contact, but there is a good deal of such work done largely for other reasons.

If boxes are babbitted directly on the same shaft, or upon one of the same size, that is to run in them, the babbitt shrinks until the diameter of the box is considerably less than that of the shaft. The practice of scraping or reaming such a bearing merely to increase its diameter is often unnecessary and may even be objectionable, for when the babbitt shrinks and makes the hole under the desired size, it also shrinks away from the matrix into which it is poured and should be forced back until it fits properly.

In ordinary boxes of the two-part type, this may be done by hammering the outside of the casting while the shaft is clamped between the two halves of the bearing. Generally, however, it is better when babbitting such boxes to have the cap drawn down tight on the liners that are to remain when the job is finished; then, after the box is poured and the oil holes and grooves provided, place it together again with the same liners and shaft between, and tighten firmly. Then hammer on all sides as far as is possible.

In nearly all cases the babbitt will go back far

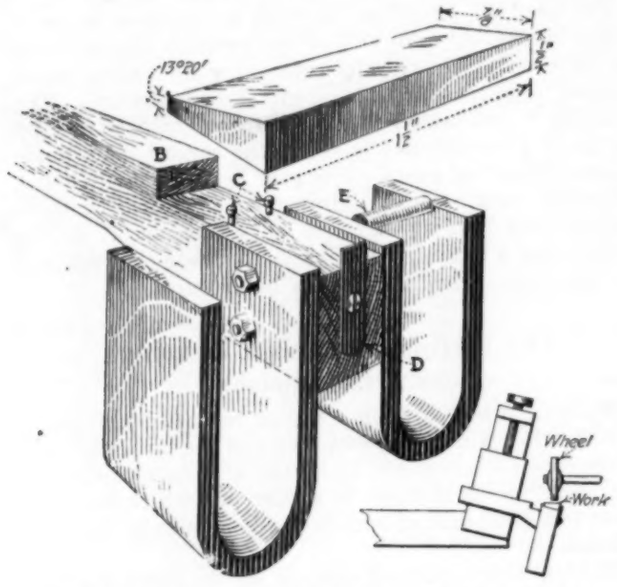
enough into the matrix to make the shaft just a nice running fit. This hammering must be done with some caution and due judgment, but on ordinary rough work of medium size it is better than reaming or scraping and does not take one-fourth the time.

The principle may also be applied to the babbitting of solid boxes. Usually these are done on a slightly tapered shaft to make removing it easier; though there are other more or less useful expedients. In any case if the box is too small after it is poured, the quickest way to make it right is to taper slightly one end of a piece of stock of the same size as the shaft and then force this well into the bearing with an arbor press, using oil to make it go better. It can be pressed in past the taper until it is quite tight. Then simply hammer all around the outside of the box and it will soon loosen up to a nice running fit.

A Home-Made Magnetic Chuck

BY ARTHUR V. O'BRIEN

The writer has hesitated for some time before relating his first and only experience in the making of a magnetic chuck, after reading the series of articles which recently appeared in the *American Machinist*



DETAILS OF THE HOME-MADE MAGNETIC CHUCK

on that subject. However, if the successful use of an article is the surest test of its value, it may not be amiss to tell about it.

In the course of construction of a built-up lamination die, it was necessary to grind the two faces of twenty-seven wedge-shaped pieces, shown at *A* in the accompanying sketch, to an included angle of 13 deg. 20 min. The pieces were first cut to length, then shaped to approximate dimensions and hardened.

After a few minutes spent in vain longing for a real honest-to-goodness magnetic chuck, and one of those adjustable blocks for use thereon, seen only by the writer in the advertising section of the *American Machinst*, his eye rested on an ancient automobile magneto that had adorned the scrap box for several years, and the great idea was born.

A piece of black walnut about 1 in. thick was bandsawed to the shape shown at *B*, the offset being necessary to bring the poles of the magnets below the wheel for the first grinding. A piece of non-magnetic metal would have been better, but time pressed. Two magnets were removed from the magneto and fastened to this wood shank by brass bolts passing through the holes by which the magnets had been fastened to the magneto frame. The wood shank was then gripped in the tilting vise of a Cincinnati No. 1 tool and cutter grinding machine, with the jaws set horizontally and the ends of the magnets ground true.

Two brads were driven into the wood at *C* with the heads projecting about ⅛ in. above the faces of the magnets and parallel to the travel of the wheel, and the heads lightly ground to truth with the side of the wheel. A spring *D* made of a hacksaw blade was fastened in place with a wood screw, and a piece of brass rod *E* sprung between the poles of one magnet to act as a stop against the direction of rotation of the wheel. About half of the diameter of the rod projected above the top of the magnets. All this was done, of course, without removing the assembly from the machine.

The vise was then tilted 13 deg. 20 min., the angle being measured by an accurate protractor between the table of the machine and the finished edge of the vise jaw, instead of using the usual graduations on the vise. In use, one tapered block was placed on the magnets with the thin edge against the brads and one end against the stop and the spring swung into place. When one side was ground the piece was reversed and the other side finished. As it was possible to take a fairly heavy cut, the work was finished in good time.

Within two hours of its conception the device was at work.

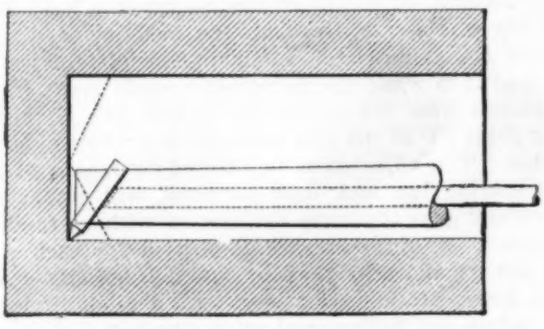
A Boring Tool of Merit

BY E. LYTTON-BROOKS

London, England

When I replied on page 113, vol. 54, of the *American Machinist* to the article under the above title by John Houssman which appeared on page 278, vol. 53, I had no desire to throw down the glove or deprecate the tool in question. I grant that small bottom clearance is required, and is an advantage.

When Mr. Houssman stated the above advantage in connection with blind holes, I naturally concluded he referred to squaring up. There are many boring tools in use that will bore and square up blind holes, and which are at the same time just as useful for straight



A BORING TOOL OF MERIT

through holes. His tool looks sturdy and rigid but if the toolbit projected beyond the toolholder, as shown in the sketch, would it not add further to its usefulness by giving it a wider range?

EDITORIALS

Crowbars and Economics

THE second article in this issue is the first of six more or less related talks on the theory of business by Ernest F. Du Brul. The author has chosen a rather picturesque style of presenting his message but he gets it over in a fashion that dispels the terrors from the little-understood science of economics.

When times are hard business men naturally are keen to know when they will improve and their interest in the more theoretical side of business is stronger than in times of plenty when almost anybody can make money. With each successive depression in the wave of business the analyzers learn a little more of the laws that govern these unpleasant fluctuations. We have still very much to learn about the comparatively youthful science of economics which is scarcely five generations old. In fact we know so little about it yet that there is some question as to whether or not what we already know should be dignified by the name of science.

We are learning fast, however, and each contribution to the common fund of knowledge brings us one step closer to the golden age when the hills and hollows will be ironed out of the business curve and there will be no more panics.

Normal Business—and Profits

WITH the largely increased machine building plants erected to meet the war emergency and the large volume of business to which we have become accustomed it is very difficult to know just what a true normal really is. Many who study the situation carefully believe that it is necessary to omit entirely the boom years in order to secure a fair basis for comparison.

One suggestion which has much to commend it is to take an average of the ten years preceeding 1914 as a basis. To this should be added a normal rate of growth for the seven years which have passed since that time. This it is believed, is a fair basis for judging the present volume of business.

The question of profits also needs to be considered. Among the suggestions of the unemployment conference was that profits should be brought to a much lower point than we have been accustomed to expect during the past few years. It is believed that a normal profit on a pre-war basis will help to restore confidence and stimulate the resumption of trade. For though price alone may not secure an order, it helps to determine whether or not it will be profitable to replace an old machine with a new one.

Profits must, of course, be carefully considered but under a normal condition rather than with the present high cost of selling and other expenses. If all possible customers knew that the price asked involved only a fair profit as judged by pre-war standards, it would greatly stimulate buying in many quarters. And a little stimulation would go a long way toward helping business get on its feet once more.

Have It Done Now!

THE Unemployment Conference has brought out clearly the fact that unemployment is a nation-wide problem and not to be remedied by legislation, except so far as appropriations for public works are concerned. It also shows, however, that it is a problem in which the individual can do much to relieve the situation.

The individual can find out what action is being taken in his town to follow the suggestions of the Conference. If none is underway, he should not rest content until something has been done. He can at least urge immediate action on the town officials.

But the individual can do more. He can help by serving on committees to find out what work is available in the town and who are looking for employment. He can look around his own house or shop and see what work needs to be done. He has probably looked them over before but decided to postpone the expenditure till later. The great trouble is that almost everyone else has done the same.

Have it done now!

No sane man is advocating making artificial work. Unless the work has a real use it becomes charity and the money might almost as well be given outright. But there is enough real work to be done to keep many employed if we make up our minds to it.

We are evidently faced by two alternatives. Either to spend money for needed work which we have postponed, or to contribute to the maintenance of soup kitchens. Some charitable relief will be necessary in any case—but much can be avoided if each of us does his part to provide as much work as possible.

One of the essential things is to get things moving. So pick out the work to be done and *have it done now!*

Action on Revenue Legislation

IT IS BECOMING more and more evident that the people of this country are growing impatient over the delay in passing some sort of tax and tariff legislation. Some one has said that our worst misfortunes never happen and it seems likely that the saying applies here.

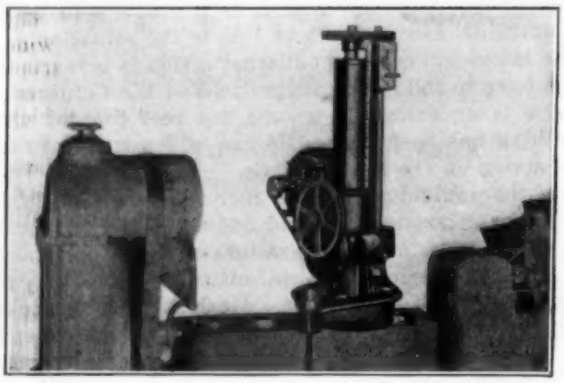
In any event the suspense in which business is struggling is much worse than almost anything our able legislators can do—hence the cry for action.

The most sensible suggestion that has so far emerged from the welter of the conflict is that of one of the ablest economists in the Senate, Mr. Smoot. His idea of wiping the slate clean and starting afresh with a few simple, easily understandable tax provisions is very wise and his three per cent sales tax is growing in favor. It is unlikely that the Smoot amendment will get into the present bill but there is good reason to hope for better things next year. Mr. Penrose is quoted as saying that the present bill is an emergency measure and that immediate consideration will be given to "radical innovations" and "novel and untried suggestions," when it is out of the way.

Shop Equipment News

Storm Motor-Driven Cylinder Reboring Machine

The Storm Manufacturing Co., Sixth Ave. and Fourth St. So., Minneapolis, Minn., is placing on the market the cylinder reboring machine shown in the accompanying illustration. The device is said to be suited especially to the needs of the average sized garage, where electric current is available. It is adapted for use on practically all types of automobile and tractor engines. It can be used for reboring motor cylinders with the motors still in the chassis, as shown. For work in the machine shop where the cylinder blocks are detached from the automobile, a heavy base is provided for mounting the machine.



STORM CYLINDER REBORING MACHINE

The cutter head is supported on a hardened and ground steel bar, which runs in long bearings provided with adjustment to take up wear. The capacity of the machine is for cylinder diameters from 2⅝ to 6 in. An internal feed screw controls the feed of the cutter bar. The machine weighs approximately 300 lb.

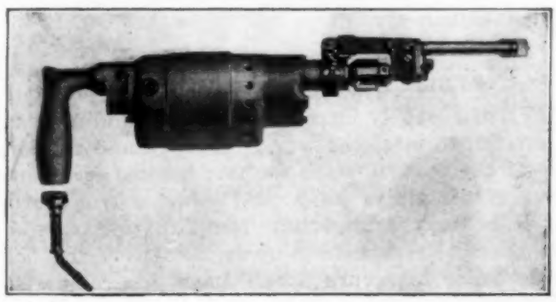
A burnishing head can be furnished, if desired. The head, which can be fitted to the spindle in place of the boring head, carries ground steel rollers around its periphery. When using the burnishing head, the cylinders are first bored slightly under the desired size. When the burnishing head is passed through the cylinders, the rollers compress the metal so as to give it hardness and a polished finish.

"Dumore" Combination Drill and Valve Grinder

The Wisconsin Electric Co., Racine, Wis., has recently placed on the market the combination electric tool shown in the accompanying illustration, for use especially in garages and service stations. The device is adapted to various uses, for drilling holes, for grinding motor valves, and for service as a portable grinder and buffer.

When carrying either a drill or a grinding wheel, the rotation of the spindle is, of course, continuous. For the grinding of automotive valves in place on their seats, a separate attachment is used on the drill, and an oscillating motion is given to the attachment spindle for driving the valve. It is stated that the device oscillates the valve more than 1,000 times per minute, so that very deeply pitted valves can be quickly ground. The illustration shows the device equipped with the valve-grinding attachment, which can be very quickly fitted to it. Four hardened tool-steel driving blades and a can of grinding compound are furnished with the device. The tool can be furnished with a steel brush attachment for use in removing carbon from combustion chambers.

A universal motor is used in the machine, so that it can be operated by either direct or alternating current. The housing is made of aluminum. The spindle of the machine is offset from the center of the motor casing, so that drilling can be performed in corners. The drive is through tool-steel helical gears, hardened and ground, and S.K.F. self-aligning ball bearings are used for both radial and thrust loads. A Jacob's chuck is furnished with the device, as well as 10 ft. of cord, a plug and a switch. The machine is made in two seats, a separate attachment is used on the drill, and sizes, the Model 1-AB and the Model 1-BD, the latter being illustrated. The capacity in steel of the former drill is $\frac{1}{2}$ in. and of the latter $\frac{1}{4}$ in. The lengths over all



"DUMORE" COMBINATION DRILL AND VALVE GRINDER

are, respectively, 10 and 12½ in., and the weights 4¾ and 5 lb. The tool is said to be easily handled by means of the pistol grip, and to be sturdily constructed so as to give long life.

Milburn "American"-Type Regulator

The accompanying illustration shows a pressure regulator intended for the control and delivery of acetylene, oxygen, hydrogen, and other gases under high pressure, such as are used in welding. It was recently placed on the market by the Alexander Milburn Co., 1420 W. Baltimore St., Baltimore, Md. The regulator is said to maintain a constant, predetermined pressure, regardless of fluctuations in the initial pressure line and of variations in the consumption at the torch.

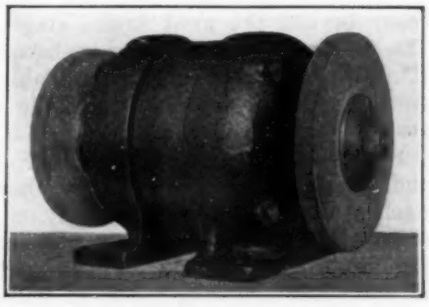
The body of the regulator contains a flexible metal diaphragm suitably mounted in connection with a tension spring. Also, there is in it a fixed nozzle containing a loose operating pin. Over the nozzle is loosely assembled the valve sleeve, which has a row of gas ports drilled around its circumference and carries the valve seat. The seat is closed against the nozzle by the

initial pressure of the gas on the valve sleeve and by the pressure of the compensating spring. The operating pin inside the nozzle is actuated at one end by the pressure of the diaphragm and at the other by the pressure of the valve seat. The seat of the regulator closes with the pressure instead of against it, which enables the sealing to be effected by the application of a very slight force. The closing of the seat is independent of the diaphragm. It is said that in operation a perfect balance or equilibrium of pressure is maintained at all times, the device throttling the supply when the desired pressure has been maintained and increasing the supply when the requirements of consumption lower the delivery pressure. All of the main operating parts are easily accessible for examination and cleaning. The makers claim that, on account of the simplicity of the design, the device has great accuracy of regulation, as well as durability. In order to adapt the regulator to different types of gas, it is necessary merely to change the gages and the rear connections on it for fitting to the containers. The illustration shows the regulator equipped with a coupling and gages for use on an acetylene tank, the receiving gage registering up to 500 and the delivery gage to 30 pounds per square inch.

MILBURN "AMERICAN" REGULATOR

Forbes & Myers Motor-Driven Grinder

In the accompanying illustration is shown a small electric-driven grinder recently placed on the market by Forbes & Myers, Worcester, Mass. The machine is adapted to general light work, but is especially intended for use on farms where electric current is available. It is stated that by the use of the grinder, farm tools can be sharpened in much less time than on a grindstone. The motor is fully inclosed, so as to protect the windings from injury. Ball bearings are used, the maker stating that they are packed in sufficient grease to last for several years. The machine is built to operate at 3,600 r.p.m. on 110-volt, 60-cycle alternating current. It can be supplied either in the bench type, as shown, or mounted on a pedestal. Two straight-face wheels, one coarse and one fine, are ordinarily furnished, although beveled and round-face wheels can be supplied. The machine is made in two sizes, the No. 42 having a capacity of ¼ hp. and the No. 62 of ½ hp. The former carries wheels 6 x ½ in. and the latter 6 x 1 in. in size.

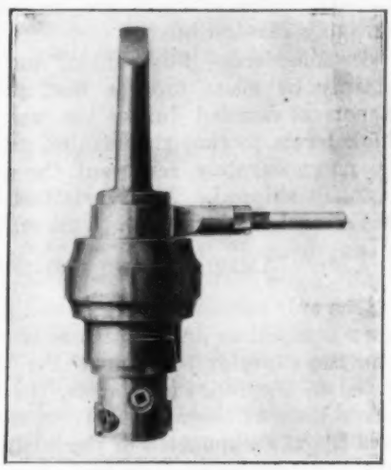


FORBES & MYERS FARM GRINDER

The diameter of the spindle is ½ in., and its length is 11 in. for the No. 42 machine and 12 in. for the No. 62. The spindle is 3½ in. above the bench in the bench-type machine, and 39 in. above the floor when mounted on a stand. The weights are 30 and 40 lb., respectively, while the weights when mounted on the pedestal are 130 and 140 lb.

Jarvis Friction Tapping Device

The Geometric Tool Co., New Haven, Conn., has recently placed on the market the Jarvis friction tapping device that is shown herewith. The device is intended for use when tapping small holes in tough metal, its purpose being to prevent the breakage of taps and the stripping of threads. As can be seen by the dotted lines, the device is provided with a friction cone, at which point slippage can take place in case the tap should become lodged in the work. It is said that only a small pressure is required to drive the tool, and that the driving force is controlled by the pressure placed on the spindle of the machine. The tap itself can be started and stopped while the spindle is rotated. The device is made in only one size, known as the FD, and it has a tapping range up to ¼ in. It is equipped with a standard chuck for holding the taps.



JARVIS FRICTION TAPPING DEVICE

China's First Automobile Show

The Shanghai Automobile Show, to be held during the week of Nov. 26-Dec. 3, will be the first exhibit of that character ever held in China. The officials of the show have suggested through a cablegram from Trade Commissioner Lynn W. Meekins that it would be well for American manufacturers of automobile accessories to make arrangements with exporters interested in the China trade for an exhibit of their products. In order to reach Shanghai in proper time, it would be advisable to ship samples of accessories and other display material through parcel post or express by way of the Pacific. The existence of a branch of the United States Post Office at Shanghai enables parcel-post shipments to be made under domestic rates and conditions. A majority of the best known American, French, and British automobiles will be displayed by local representatives. A list of importers of and dealers in automobiles and automobile accessories in China may be obtained from the Bureau of Foreign and Domestic Commerce or its district and co-operative office by referring to File No. FE—13011-A.

Machine Tool Exports

United Kingdom Our Only Serious Competitor—American Foreign Business Not Readjusted to Peace Basis—Far Eastern Markets Promising

By W. H. RASTALL
Chief, Industrial Machinery Division Department of Commerce

SUGGESTIONS as to the prospects for foreign trade in machine tools, the strength and trend of foreign competition, and the markets that are now active are provided in the following analysis of the experience of recent years. This industry has been most strongly affected by the war and reconstruction, and in America is feeling acutely the depression that has spread over the entire world during recent months; while in contrast to this position, the latest returns indicate that British manufacturers are enjoying a constantly increasing foreign business.

In considering this subject due allowance must constantly be made for the fluctuations in prices. The abnormal demand during the war raised quotations to high levels so that the results, as expressed in dollars, do not accurately represent the quantities or tonnage actually shipped. Also variations in exchange confuse the situation where foreign currencies are employed.

American and British Exports

The only nation that occupies a position of importance as a competitor in this trade is the United Kingdom, and the superior position of the United States is indicated in the following tables, the first of which shows the volume of the exports from each of these countries and the vast expansion of the business from both during the last few years.

It is scarcely accurate to speak of the above countries as competing in this trade, for as is well known the differences in design are so great as to constitute two distinct classes of equipment. Generally speaking, the British tendency in design is toward "universality," that is to say tools, each of which may perform a variety of services as contrasted with the American tendency toward "specialization," the production or single-purpose machines. To a certain extent Table I also expresses the comparative demand in the world markets for these two types of equipment, and from the nature of the services rendered, neither could expect to exclude the other, as the single-purpose machine is the type suited for manufacturing while the other type has advantages, for example, in the small repair shop. This is illustrated in another way by Table II, and it will be further noted that this table also emphasizes the pre-eminent position of American manufacturers in the machine-tool trade of the entire world, for even before the war the United Kingdom would import machine tools from the United States to a value of from a quarter to a third of her own total exports.

TABLE I. EXPORTS OF MACHINE TOOLS

Year	*Exports from United Kingdom	(b) Exports from United States
1909	$3,734,837	$9,640,034
1910	3,473,072	5,975,503
1911	3,691,121	9,626,965
1912	4,543,813	12,151,819
1913	4,922,208	16,097,315
1914	4,958,108	14,011,359
1915	3,744,552	28,162,968
1916	5,427,930	61,315,032
1917	10,262,750	84,935,410
1918	6,222,433	51,620,297
1919	(c)	58,507,942
1920	(c)	44,312,233

* Converted at $4.86 per pound.
(b) Fiscal year to 1917 — calendar year 1918 and after.
(c) Detailed figures not yet received.

It will be noted that entirely apart from war influences there has been a strong tendency in Great Britain toward the adoption of American style machines, the high percentage that has so long been purchased from the United States, and the steady increase in this volume since 1910 indicating a genuine appreciation of our methods. It seems probable that a reasonable demand for our tools will persist indefinitely even though the experience of recent months shows a serious reduction in these exports for the time being. On the other hand, there seems to be very little to recommend the British type of equipment as the volume of shipments to the United States is not large enough to be given separate mention in the British returns.

TABLE II. BRITISH EXPORTS AND IMPORTS OF MACHINE TOOLS

Year	Exports from U. K. £	British Imports from All Sources £	British Imports from U. S. £	Percentage from U. S.
1909	768,485	81,155	68,293	84
1910	714,604	81,978	66,078	81
1911	759,490	214,219	192,863	93
1912	934,941	282,643	260,100	92
1913	1,012,800	361,440	324,832	90
1914	1,020,187	427,049	376,605	88
1915	770,484	2,128,383	2,099,076	99
1916	1,116,858	2,911,746	2,849,281	98
1917	2,111,677	2,654,825	2,616,286	98
1918	1,280,336	3,858,264	3,771,994	98
1919	.....	.....	.....	..
1920	.....	.....	.....	..

Signs of Improvement

With the foregoing as a brief statement of the position of American equipment in the world machine-tool trade and its history during the last decade, with an estimate of its trend and nature during that time, it is desirable to give closer attention to the present situation, for American exports seem to have fallen to very low levels. This, of course, is but an incident of reconstruction, the depression following the feverish business of recent months, and there are signs that we are already beyond the most severe stages of this collapse. The changes in our exports are shown in detail in Table III, it being remembered from Table I that 1920 represents more or less faithfully the experience of the years since 1916.

British experience is in very sharp contrast with this and it seems that the industry there has readjusted itself pretty well and is practically on a peace basis once more. Data given in the preceding paragraphs indicates the situation there during the earlier years of the decade. The following report of Wilbur J. Page, American Trade Commissioner in London, shows the more recent experience:

"The July returns show a fall in both imports and exports in tonnage and total value, though there is a slight rise in the value per ton. The imported tonnage has been settled at a low level for five running months, and it seems unlikely that Great Britain will import more machine tools than before the war.

"The usual comparative table (Table IV) shows that

on all points the present year is turning out very favorably. The decline in imports is too heavy and prolonged to be regarded as a mere fluctuation. The exports are very much above any previous record in deadweight of machinery—about double the level of 1919—and this high level is the result of a fairly steady increase over two and a half years. It is remarkable that the price

TABLE III. AMERICAN EXPORTS OF MACHINE TOOLS

	Lathes		Other Machine Tools	
	1920	1921	1920	1921
Jan....	$631,271	818,068	816,773	1,222,731
Feb....	587,348	442,491	895,675	778,250
Mar....	1,079,793	337,856	1,943,230	528,563
Apr....	560,008	335,614	1,229,819	379,320
May....	829,434	269,835	1,318,478	254,326
June....	846,583	131,140	1,127,297	267,344
July....	542,175	191,983	915,074	281,936
Aug....	414,604	51,569	972,247	209,630
Sept....	506,781	.....	1,176,175	.....
Oct....	358,088	.....	1,170,075	.....
Nov....	589,444	.....	1,131,461	.....
Dec....	629,594	.....	1,264,939	.....
Total	7,575,123	.....	13,961,243	.....
1919	10,136,877	.....	12,490,600	.....
1918	9,853,507	.....	11,626,360	.....

	Sharpening and Grinding Machinery		Other Metal Working Machinery	
	1920	1921	1920	1921
Jan.....	$394,374	$296,385	$1,611,528	$1,956,879
Feb.....	261,209	148,210	2,024,929	1,412,630
Mar.....	475,248	95,645	1,652,604	1,359,489
Apr.....	334,269	84,946	1,489,625	1,255,542
May.....	276,057	82,183	1,919,421	669,627
June.....	395,903	60,499	1,134,940	1,029,230
July.....	396,246	105,293	1,823,097	1,155,283
Aug.....	278,864	61,711	1,242,778	608,653
Sept.....	333,844	.....	1,190,343	.....
Oct.....	247,788	.....	1,556,908	.....
Nov.....	237,395	.....	1,373,323	.....
Dec.....	314,293	.....	1,557,881	.....
Total	3,945,490	.....	18,830,377	.....
1919	5,494,060	.....	30,386,405	.....
1918	6,161,876	.....	23,978,554	.....

of exported machine tools did not rise in step with the general inflation of values, and that the price is now being maintained against the general falling tendency; also that this comparative steadiness of value is accompanied by an increasing trade."

Returns showing the countries to which this equipment has been shipped have not yet been received, but so far as may be judged from American and earlier experience, the heaviest demands are from Europe. It is not at all certain that it is good policy to concentrate too strongly on these markets because of the abnormal conditions. The demand there for American types of equipment seems to have fallen to very low levels and

TABLE IV. IMPORTS AND EXPORTS OF MACHINE TOOLS FOR UNITED KINGDOM

Periods: Seven Months January to July	Total Weight Tons	Total Value £	Value per Ton £
Imports of Machine Tools			
1911-14 (pre-war average)	1,930	187,447	97
1915-18 (war average)	11,370	1,681,927	148
1919	11,120	2,660,040	239
1920	8,221	1,805,432	220
1921	2,379	532,199	224
Exports of Machine Tools			
1911-14 (pre-war average)	8,927	543,583	61
1915-18 (war average)	8,037	771,218	96
1919	7,175	1,024,110	143
1920	11,675	1,604,639	137
1921	14,629	2,124,309	145
Exports of Engineers' Tools, Milling Cutters, etc.			
1920		915,779	
1921		611,005	

it may be anticipated that British manufacturers will soon feel the same influences or else there will be a revival here.

The Far Eastern Markets and Other Groups

The markets of Asia rank next in importance; and Japan, British India, China, the Dutch East Indies and some of the smaller markets show signs of absorbing an increasing quantity of our equipment. Asia is being industrialized far more rapidly than many of us realize. The next group in order of importance is that including Cuba, Mexico and South America, and although these countries are having serious financial problems, their markets deserve careful attention. The business from even the smallest countries as, for instance, in Central America, is increasing nicely. Australia, New Zealand, and the various countries in Africa give similar promise.

Steel Specifications Submitted for Approval

The American Engineering Standards Committee has now before it for consideration and approval A. S. T. M. standard specifications for cold-drawn bessemer steel automatic screw stock and cold-drawn open hearth steel automatic screw stock.

The materials covered in the two specifications are intended for use in making machine parts in automatic and other rapid-cutting machines in which the highest cutting efficiency is sought, consistent with the nature of the metal specified.

Specifications Date From 1909

The history of the preparation of these specifications dates from 1909, when a committee was organized by the American Society for Testing Materials to prepare standard specifications for cold-drawn steel. In the discussion of specifications for automatic screw stock it became evident that considerable data were required, particularly with reference to material used for machining at very high speed. The committee accordingly undertook a series of tests to determine features which would affect the working qualities and physical characteristics of standard automatic screw stock. The various consumers represented on the committee placed orders with each of the producers for cold-drawn steel for automatic screw machine work for test purposes, and a total of about twenty tons of material was thus furnished and tested. These tests were completed in 1913. The specifications covering bessemer stock were adopted by the society in 1914, and, after revision, the specifications for open-hearth stock were adopted in 1915. There have been no revisions since adoption.

Specifications Ready for Development of Foreign Trade

These specifications have been translated by the Department of Commerce into French and Spanish for distribution in connection with the development of foreign trade.

The specifications are submitted in accordance with the special provision in the procedure of the American Engineering Standards Committee under which important standards in existence prior to 1920 may be approved without going through the regular process followed in new work.

The committee would be very glad to learn from those interested of the extent to which they make use of these specifications and to receive any other information regarding the specifications in meeting the needs of the industry.

These specifications may be found in the 1918 volume of A. S. T. M. Standards. Copies may also be obtained from the American Engineering Standards Committee, 29 West 39th Street, New York City.

Industrial Conditions in Europe

England, France and Germany Better Off Than We Realize—Value of Foreign Branch Factories to American Firms—Better Times Coming

By A. C. HIGGINS
Treasurer, Norton Co.

I VISITED England, France and Germany and in the brief opportunity I had for observation it seemed to me that Europe is not materially and industrially as badly off as I expected to find it. In many ways they have made substantial progress to more normal conditions.

Industrial affairs in England are somewhat complicated by their socialistic experiments, most of which have failed to accomplish what was expected of them. For example, the attempt to solve the problem of unemployment by payments based on idleness rather than on work is an economic failure. Not only in England and France but in Russia people are beginning to realize that the millennium is not to be brought about through governmental agencies, but rather through the orderly operation of economic laws. England, the greatest trading nation in the world, knows what competition is, knows that her future depends upon foreign trade, and is getting ready to meet it in her own shops and with her own ships.

English people are more fully informed on foreign affairs, foreign trade and foreign policies than our people, and the tradesman's common-sense, common to all the English people, will not allow them to sacrifice too far the advantages they have enjoyed for the pipe-dream of some radical labor agitator.

France is fundamentally an agricultural country, a country of well-to-do peasants, and as such is more prosperous than we have been led to believe, and more prosperous, I think, than they would like us to believe. I spent two days going over the battle-line and through the devastated towns from Chateau Thierry through Rheims to Soissons, and, except in some few places which had not been cleaned up, the broad fields which had been furrowed with trenches and blasted by shells were fully and intensely cultivated. Crops have been very good and dire poverty is not in evidence.

Of course the manufacturing industry is at a low ebb but unemployment is not marked, and I was told that the men out of work in industry were back on the farms where they work for food and lodging so that foodstuffs are produced more cheaply and prosperity gets its fundamental start. The French know how to live cheaply and when times are good they save money. In other words, they are thrifty.

In Germany it appeared to me that conditions were better than in any other country I visited. Not only are they not looking for any outside help such as the allied countries may expect from reparations, but they do not seem to be worrying about the reparations, and it appeared to me that they do not seem to believe they would ever be forced to pay or if at all not in any way that would inconvenience them to any great extent.

Germany, of course, is a great manufacturing and industrial country and while France and England are industrially flat German industry is comparatively quite prosperous. With the mark at so low an exchange value they can undersell any other country, and realizing in a sense that they were defeated temporarily in their ambitions, their workmen are willing to take what they can get. There seems to be a general feeling that if things had been a little different they would have won the war, and I could not, in my talks with them, and with others who had spent more time in Germany than I did, help but feel that they expect next time that difference will be in their favor. I do not mean that Germany is now looking for a military revenge. I found no evidence of this. But I found many indications which led me to believe that Industrial Germany, the most important influence in that country today, is expecting to achieve commercial supremacy by the same kind of "will to power" which they exercised in the war. Their factories are uninjured and in a high state of efficiency. They are operating and making money. They have wonderful opportunities in Russia and the Balkan States and are making the most of them.

France does not have this kind of military spirit in commerce and industry but she recognizes it in Germany and fears it—fears that this very definite menace may lead to the military revenge only faintly if at all cherished by industrialists, but which will always be encouraged by the old regime. France would like to throttle Germany commercially while England believes the economic difficulties to this course are insurmountable and the dangers to her own Empire too great.

Of course, one cannot help experiencing a bitter resentment in coming to the realization that Germany is not likely to get a fraction of what she deserves or to render any adequate reparation for her crimes. If she pays in goods or labor when other countries need the work for their own people she benefits more than she suffers. Anything which will keep her factories going full time and her people employed is to her immediate advantage. As the mark goes down wages and prices are adjusted and the volume of trade increases. This complete cycle happened in our own German factory while I was there. The prices of German goods are irresistible, in other countries where they have found their way, and their volume must increase if economic laws operate. Some have predicted that this is leading Germany to bankruptcy, but a bankrupt can run a long time and be a mighty dangerous competitor particularly if he thinks he must eventually make the poor-debtor's appeal to the courts for a fresh start. It is said that a good deal of foreign capital, especially American, is becoming interested in German industries since the war. I was not able to verify this but I have no doubt that it is welcome and a friend in court is regarded as a valuable factor in future settlements with victors or creditors.

I saw no reason to believe that the allied countries could not pay their debt to the United States. I think so far as we are concerned we ought to do as a government what any good business concern does in such times as these—retrench, collect our debts, watch our credits and go after the business of the world. It seems to me we have had enough sentimentality in our government and enough opportunism in its conduct to serve

for a long time and that we ought to get back to sound business principles. I got the impression in England that there was more of a demand for governmental economy and more serious attempt to meet that demand by their government than in this country. It may be a mistaken impression, but I felt in England that the government was a good deal more sensible to the demands of the people and a good deal more directly answerable to them than our Congress.

I was very much impressed in England, especially in the great amount of foreign news we found in the newspapers and met with in conversation on the street, in the hotel and at the dinner table. We do not have the same feeling about foreign affairs that they do. Our old isolation and independence is the basis of our thought, but conditions have changed so that we must figure on other countries and take into account what they are doing. Under the present exchange, labor and political conditions I feel that our company, for example, would find it very difficult to do much foreign business for quite a while but having plants now both in France and Germany I feel very confident that we can meet such trade opportunities as may offer in European countries through those plants, whereas we could hardly expect to meet them from our Worcester plant.

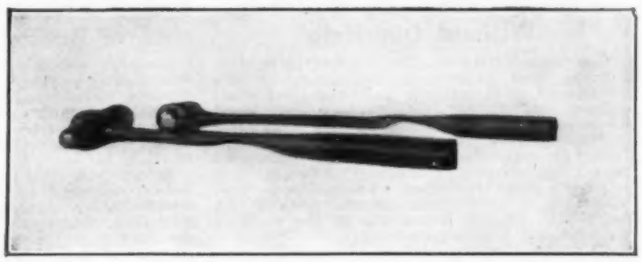
Not only do these European countries figure on the reactions of other countries to their trade policies but politically they are trying their cases before the bar of the world. For example, Lloyd George's letters and messages on Ireland have been written fully as much for America as for England. France cannot settle her policy with Germany without England or against our disapproval, and I think we shall find that when we come to settle the Japanese question that like these other questions it will have to be tried before the people of the world. I felt, however, more thankful than ever before that we were not mixed up politically in European affairs. They are in an awful mess and we have plenty to do on our own Continent without seeking to right things on other Continents.

In the United States I do not believe we have gone so far as the European countries have in reaching a more normal condition. Of course America is a big country and we will do a large business here before we will do it abroad, but some of that business which we should do will be done by the European countries in our own home markets, unless we wake up to the fact that we must get back to more normal conditions and unless we insist that our government cut out the extravagance which is responsible for our burdensome taxes and promptly adjust our tax and tariff laws. I am afraid that Europe will enjoy a real prosperity before we do and that we will be expected to be the easy marks to finance them. It seems to me that the European people learned from the War a lesson of real sacrifice and with the dangers which confront them recognize that they must continue to sacrifice to work back to more normal conditions. I am afraid our people never had this realization and that only an extended period of dull times will bring it. Still I share the usual American feeling that nothing can stop the prosperity of our country and that economic abuses here will not have as dire an effect as they would in countries of less wonderful resources. My feeling is that we have seen the worst of the depression and that gradual improvement will take place.

Are Hollows Worn in Hammer Handles?

BY H. F. PENNEY

How often is it that they have to renew the "Blarney Stone" because of its wearing away under the kisses of the seekers of its potent charms? And it is said that similar salutations have worn away several big toes from a certain statue of St. Peter. Mr. Thwing



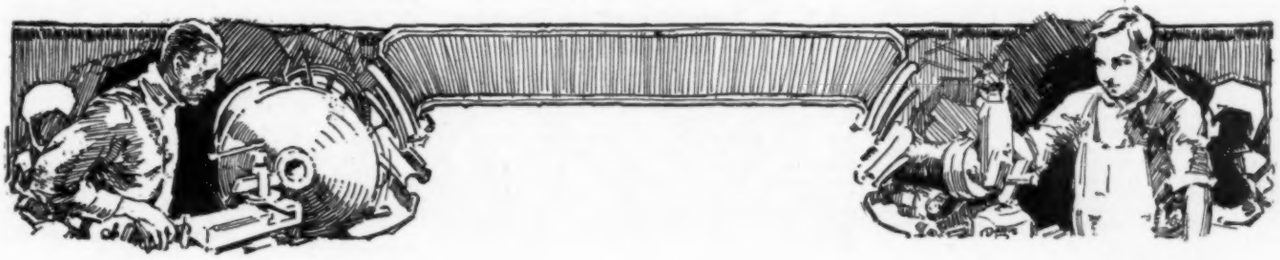
HOLLOWS WORN IN HAMMER HANDLES

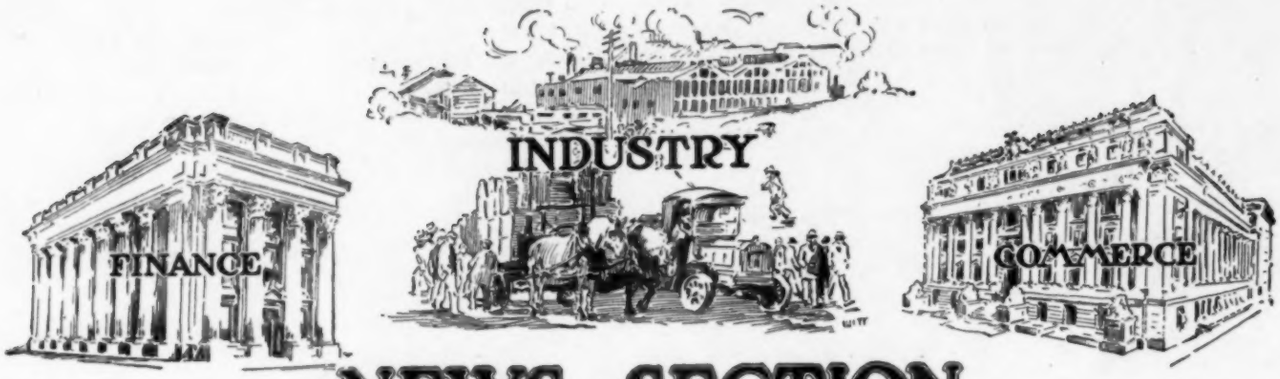
apparently forgot this tremendous cumulative effect of small forces many times repeated, when he wrote, on page 980, Vol. 54, of *American Machinist*, his skeptical comment on the grooves in hammer handles.

Fingers certainly do wear grooves in hammer handles and the fingers are not necessarily grimy nor the work done laborious. This is splendidly illustrated by the hammers used in our handle department; two of them are shown in the accompanying photographs. These small hammers are used by girls for driving the light rivets in the assembling operations on razor handles. During a day the hammers are laid down and picked up hundreds of times and I believe that it is the friction of the hand in doing this as much as that of driving the rivets that causes the excessive wear.

The large groove is worn by the thumb. There is also another very pronuonced groove worn by the forefinger but this does not show as plainly in the photograph as it is at a more acute angle across the handle. All the hammers used on this operation show this same effect, the degree depending on the time they have been in use.

I have no doubt that Mr. Thwing will have countless examples of similar action brought to his attention and I believe that if he will look at the spacing bar on any typewriter of not too recent vintage he will find that even the dainty thumb of a stenographer can leave its impression.





NEWS SECTION

Europe Cannot Be Restored Without Our Help

Conviction that the United States cannot refrain from active participation in the settlement of economic and financial difficulties confronting the world, is expressed by a special committee of the Chamber of Commerce of the United States just back from an extended trip through European countries where government officials and business leaders were interviewed and where in a close study on the ground the committee sought the views of the various elements of the populations.

In every country visited the opinion was expressed that neither Western nor Central Europe can be restored to a condition which promises hope and progress for the future without our assistance. Every country desires our friendship and assistance and it is apparent we can participate in the restoration of commercial and industrial productivity on any reasonable and consistent terms, either by modification of the Versailles treaty to meet the policies of the United States, or independently of it.

A chief obstacle at present to a return to normal business conditions throughout the world, the committee asserts, is found in the armed conflicts in progress and in the continued threat of renewed clashes. Business will not resume its forward movement, it is declared, until the menace of recurring warfare is removed. The conclusions of the committee based on an intensive study are published in a special report now available.

On the Chamber's committee are Joseph H. Defrees of Chicago, president of the Chamber; John H. Fahey of Boston, former president of the Chamber and Director of the International Chamber of Commerce; Silas H. Strawn of Chicago, chairman of the board, Montgomery Ward & Co.; Robert P. Lamont of Chicago, president, American Steel Foundries Co.; John J. O'Connor of Washington, manager, finance department, Chamber of Commerce of the United States; and James H. Douglas, Jr., secretary.

Federal Trade Commission Cites Machine Co.

The Berkeley Machine Works, Inc., engaged in repairing ships at Norfolk, Va., has been cited in unfair competition complaint by the Federal Trade Commission. Thirty days are allowed the company to file its answer, after which the case comes on for trial on its merits. A complaint is issued after a preliminary investigation upon petition being filed with the commission.

The complaint recites that the firm gives to captains, and other ship officers upon whose ships repair work is done, by the company, certain cash commissions to induce the officers to have their vessels repaired by the respondent. These commissions are given without the knowledge of the ship owners. The commissions are alleged to add to the firm's cost of business approximately $25,000 a year, which sum is covered in the bills presented to ship owners for payment, thus becoming a charge upon them which eventually the public must pay. The complaint avers that the practice is unfair and tends to cause competitors to give like commissions to vessels at the port of Norfolk as a means of protecting their trade.

Feiker Advocates Federal Survey of Business Conditions

Federal publication of daily surveys of business conditions, similar to the weather reports, was suggested by F. M. Feiker, special assistant to Secretary of Commerce Hoover, in an address before the Industrial Engineers Conference at Springfield, Mass., on Oct. 5.

Every business man in the country, Mr. Feiker declared, is waiting for some concise authoritative daily guide to the business situation, such as the forecasts of the weather now printed in the top right-hand corner of practically all newspapers. He said the Department of Commerce had already taken a step in this general direction through the publication of a new service known as the "Survey of Current Business." He asked the co-operation of American business men in perfecting this service.

Mr. Feiker also discussed the subject of the elimination of waste in industry. He said that while this country had the highest ingenuity and efficiency in the operation of its individual industries of any nation, the American industrial machine is as yet far from perfect. In summarizing the principal factors contributing to industrial waste, he mentioned: (1) Lost labor during depression; (2) speculation and over-production in booms; (3) labor turn-over; (4) labor conflicts; (5) failure of transportation, fuel and power supplies; (6) loss due to processes and materials; (7) excessive seasonal operation; and (8) lack of standardization. He said all these factors combined resulted in a huge deduction from the goods and services we might all enjoy if we could do a better job of it. In his opinion, the best opportunity for advance in living standards lies in the steady elimination of these wastes.

Mr. Feiker said that the Department of Commerce is planning more systematic co-operation between industries and the U. S. Bureau of Standards, which he described as the greatest scientific laboratory in the world. "That Bureau has hundreds of contacts with industry, but there are still a great many manufacturers who could make very effective use of its wonderful facilities if they were more familiar with the services offered," he declared.

Mr. Feiker also mentioned the establishment of a "Division of Building and Housing" in the Department of Commerce. He said that through the asistance of committees in the industry and an active staff in the department, in Washington, definite recommendations are being drawn up for a standardized building code which will do much to simplify construction and reduce costs and prices.

I. C. S. Entertained by Bantam Company

About forty representatives of the various branches of the I. C. S. were entertained at the factory of the Bantam Ball Bearing Co., Bantam, Conn., Oct. 12. Dinner was served in the recreation room of the factory, followed by speeches and a program of motion pictures pertaining to the work of the schools. As a special feature the picture, "The Acorn and the Oak," portraying the growth of the Bantam Ball Bearing Co., was staged in the factory theater.

F. R. Lindh Joins Staff of Chicago Belting Co.

Fritz R. Lindh formerly chief engineer of the Graton & Knight Manufacturing Co., has joined the sales organization of the Chicago Belting Co., Chicago, Ill. Mr. Lindh is a West Point man, graduating in the class of 1914. During the war he was located at Sandy Hook and Aberdeen, Md., first as a captain and later as a major. At Aberdeen he was in charge of all army testing of guns, ammunition, powder, tractors, etc.

Leaving the army, Mr. Lindh was about seven months in the advertising business as account executive for Cleland, Inc. He joined the organization of Graton & Knight last year, succeeding Dr. Wilson as head of the engineering department, where he was in charge of all field research and testing at the factory as well as of all field engineering service.

With the Chicago Belting Co., Mr. Lindh will be in charge of the Pittsburgh factory branch besides making personal engineering surveys throughout the country.

Hearings on Metric System Bill

Hearings on Senator Ladd's metric system bill were expected to begin on Oct. 11. Among the witnesses who will probably appear in favor of the bill are Harvey W. Wiley, former chief of the Bureau of Chemistry; S. L. Hilton, president, American Pharmaceutical Association; Dr. Charles L. Parsons, secretary, American Chemical Society; William J. Scheffelin, drug manufacturer of New York; Theodore H. Miller, works manager of the De Laval Separator Co.; and Howard Richards, Jr., secretary, American Metric Association, of New York.

The executive board of American Engineering Council which met in Washington Sept. 3 decided to take no part in the metric system controversy.

Barney & Smith Car Co. a Financial Loss

Suspension of further operation and sale of the plant and equipment of the Barney & Smith Car Co., manufacturer of electric street railway equipment and all kinds of railroad passenger and freight cars, are recommended by Valentine Winters, president of the Winters National Bank, according to his report in common pleas court as receiver for the firm.

Liabilities of $2,919,044.72 are listed. Of that amount $2,613,650 is shown to be owing on mortgage bonds and gold notes. Among other creditors are the E. W. Bliss Co., which holds a judgment of $55,866.04 against the firm; and Cadwalader, Wickersham & Taft, to whom $11,506.09 is owing for legal services.

The value of the company's resources is placed at $8,135,271.46; plant and equipment are valued at $3,816,181.35. A value of good will is placed at $3,029,168.69, which includes patents and trade marks.

With a volume of business of $457,033.29 during the receivership period, the firm made a gross profit of $18,448.74, which expenses reduced to a net loss.

The company's bonds are held by the Guaranty Trust Co. of New York.

The Business Barometer

This Week's Outlook in Commerce, Finance, Agriculture and Industry Based on Current Developments

BY THEODORE H. PRICE
Editor, *Commerce and Finance*, New York

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It is possible that a mistaken complacency may be induced by the prophecies of prosperity which are to be heard all the way across the continent from Los Angeles, where the American Bankers Association is in session, to New York where the American Manufacturers Export Association has been holding its annual convention. We can be prosperous if we work, but there is grave doubt whether conferences and conventions really inspire much personal effort and there is reason to fear that they may lead us to forget that "The Lord helps him who helps himself."

Of the unemployment conference at Washington it is said that it "has ended where it began." It has discovered that unemployment is a local problem and has recommended that it be dealt with accordingly. Of the Disarmament Congress to be held next month much is expected. Our expectations will probably be disappointed, for no preliminary meeting of minds between the conferees is discoverable.

Of the United States Congress now in session much the same statement is true, for although it is described as almost hysterical over the tax bill, there is no indication that it is anywhere near agreement as to which of the many plans advocated it will adopt. As to the tariff bill, it seems indefinitely shelved and a ratification of the peace treaty with Germany is also debatable in more senses than one.

But despite human mismanagement and lack of co-ordination there is abundant evidence that the machinery of American industry and commerce has readjusted itself to the requirements of a world at peace. It is, however, possible that the *ignis fatuis* if high prices will lead us into the slough of under production and this is the only danger in the present situation.

With the single exception of canned goods no acute scarcity is as yet apparent in any important staple, but in several quarters a shortage is quite possible before the winter is over. New England is commencing to realize that her reviving industries have an insufficient supply of bituminous coal. Copper is advancing because the off-take has exceeded the production for several months past. The same thing is true of lead and tin. The steel industry is picking up because so many mills were idle during the summer that there is no unsold supply of steel anywhere. Coffee is growing firmer day by day as the trade commences to realize that a coffee famine may be the result of the reduction in the coffee acreage ordered by the Brazilian Government a year or more ago. Petroleum is up from 25 to 50 cents a barrel. Dry goods are advancing though reluctantly, as the implications of the short cotton crop become better understood.

The alternative of very high prices for all these things is reduced consumption and while the producers are entitled to a living profit for their toil and risk, it would be well for them and their employees to remember that in the long run their prosperity and that of the country is directly dependent upon the magnitude of both production and consumption.

Wheat, corn and oats are almost the only important staples that have declined during the week. They have been conspicuously weak. Just why is not clear. A world's wheat crop of 153,000,000 bushels in excess of last year, and Canadian competition in the export trade, are among the reasons assigned for the drop in the American markets, but neither is entirely satisfying. The collapse of the farmers' organization for the co-operative marketing of the crop is another of the explanations offered but as there is no doubt that the producers could hold if they wished to, the truth probably is that present prices yield them a small though unadmitted profit. A reduction in the purchasing power of the West is nevertheless to be expected as a result of the decline.

Aside from the decline in grain the most striking feature of the week is the advance in Liberty Bonds which is almost sensational when the amount outstanding is considered. On Thursday last the Fourth 4¼s went up over 75 points. The improvement is directly due to the growing ease of money which is affecting the entire bond market and making it easy to sell the new issues that are being brought out from day to day. An announcement that the public debt has been reduced by $963,000,000 during the year ending Sept. 30 and that the total reduction from the high water mark of August 31 1919, is $2,672,593,000 has also helped to advance "Libertys." The gross debt then was $26,596,701,000. It is now $23,924,108,000 and it is figured that at this rate the entire debt would be retired in 16 years. The figures are, misleading but it is true that if interest rates continue to decline it may be possible to refund and extend the debt on a basis that would benefit the treasury.

The weekly statement of the Federal Reserve Banks shows no change in the reserve ratio and a gain of only $7,000,000 in gold, the smallest in many weeks. Circulation has increased by $25,000,000. The Philadelphia bank has reduced its rediscount rate to 5 per cent and the Minneapolis bank to 6 per cent. No other changes are reported.

In the industrial department the stock market has been soft reflecting the fear that some more important corporations would suspend dividends upon their preferred stock. The railroad shares have been curiously unresponsive to the improved earnings reported. The net revenue of the Class I railroads for August is estimated at $90,000,000, or at the rate of about 5 per cent upon the tentative valuation of the Interstate Commerce Commission. An autumnal shortage of freight cars in the West is now predicted. The traffic is certainly showing a rapid increase. President Harding is still urging the passage of the railroad refunding bill but Congress seems reluctant to enact it. Some day the public will realize that the railway stocks are selling at bargain prices.

Except for the statement of the German Reichsbank which shows an increase of 4,205,300,000 marks in the paper currency outstanding, the financial news from Europe is not sensational. The total of the German paper circulation is now 86,384,300,000 marks. It is somewhat surprising that the price of marks did not decline still further when these figures became known, but rumors that Germany would somehow meet her next reparation payment have had a steadying influence, and as this is written 100 marks can still be sold for about 81 cents. Just why any one should be willing to buy them even at this price is not clear. The fluctuations in other foreign currencies are without significance.

Silver has declined about two pence from the top. By some the reaction is attributed to the political unrest in India which seems to be spreading.

Riots among the unemployed are reported from London but the stock market is unperturbed. Money is growing easier and an excellent investment demand is reported.

Elsewhere in the world the satisfactory and the unsatisfactory appear to be about in balance, as usual, and while we cannot expect the wild activity of war times there is every indication that in Europe as well as in America those who are enterprising and industrious will be able to earn their keep and something more besides.

Plant and Equipment of Chapman Co. To Be Sold at Auction

The plant and equipment of the Chapman Manufacturing Co. at Winchester, Mass., will be sold at a public auction on Oct. 13 and 14. J. E. Conant & Co., of Lowell, Mass. will have charge of the sale. The factory buildings include a complete machine shop, hardening shop, boiler, house, office building, vaults, storage sheds, scrap bins and steam-heating and electric light plants.

The equipment consists of an extensive collection of standard machine tools and standard mechanical equipment of the highest class. All of this machinery was installed new during the past three years. Some of the items for sale are: Grinding wheels, gages of all kinds, ball bearings, electric grinders, chucks, dies and tapping attachments, dogs, toolholders, steel bits, and other fixtures.

The machine tools include Norton grinding machines, Fay & Scott lathes, turret lathes, Landis grinders, Greenerd presses, Rickert-Shafer tapping machines, Henry & Wright drilling machines, Chicago milling machines, Flather engine lathes and a large variety of small bench and portable machines.

In the heat-treating plant are a number of modern gas furnaces. Other machines are heavy-power shears, Bradley hammers and a few electric motors. In the storage racks are several hundred pounds of steel in strip, angles and tubes.

The Chapman company went into the hands of a receiver a few months ago. The court of Suffolk County, Mass., appointed Willard B. Luther, of Boston, as receiver and he has ordered the sale as stated above.

Canadian General Praises Mechanical Development

The contribution of the mechanic to engineering development was the subject of an address delivered by General Sir Alexander Bertram at a Rotary Club luncheon in Montreal, Canada, on Sept. 20. It was recalled that General Bertram had started out as a machinist's apprentice himself in company with his father, the latter having come from Scotland in 1852, and in association with Robert McKechnie, had established the first machine tool industry in this country.

The crudity of shop equipment as it existed in the days of his father's apprenticeship in Scotland was brought into contrast in the text of Sir Alexander's address, and in screen pictures used for illustration, with the equipment of the machine shop of today. The old lathe, driven, by a crank, industriously turned by his father as he worked his way through apprenticeship, was brought into view in company with the great machines now in use, electrically and hydraulically operated, in which the touching of a button worked the miracle of power.

Sir Alexander recalled that the first lathe built by his father and Robert McKechnie in 1862 was sufficiently uncommon to be the subject of much curiosity; and mentioned that a radial drilling machine, built by them in 1876 was exhibited at the Centennial Exposition in Philadelphia, his father receiving a bronze medal in connection therewith. He also screened an old telegram, dated 1885, signed T. G. Shaughnessy, in which the firm was asked for quotations on shop equipment.

In connection with his appreciation of the mechanic, embodied in his address, Sir Alexander said: "I started out as a mechanic; I will always be a mechanic, and I am proud of it. Outside of his own business there is not much heard of the mechanic, but he is nevertheless the main factor today, as he always was, in the development of mechanical engineering. No finer type of man exists than the real, first-class mechanic and he should receive a great deal more credit with the outside public than his modesty permits him to claim."

Electrification of Japanese Railways

The official system for the electrification of the railways of Japan has recently been revised and a new electric bureau established, states an issue of the *Yokohama Chamber of Commerce Journal*. According to the plan now being worked out by the Department of Railways, the first steps will be to electrify the entire Tokaido line, whose traffic has been increasing enormously each year, from Tokyo to Kobe, and a part of the Central line between Iidamachi station in Tokyo and Kofu, in the rear of Mount Fuji, where many tunnels make transportation slow. Electric trains will be used exclusively for passengers, freight trains being propelled by steam as at present.

Penn State College Perfects Employee Training Plan

Pennsylvania State College has worked out a plan for employee training which appears nearer to the ideal than anything yet attempted. The methods adopted by this institution have long since passed the experimental stage and are in operation in a large number of plants in Pennsylvania, where it has been demonstrated that an efficiency far beyond that of ordinary class instruction can be obtained.

For ten years past a staff of highly trained men in industrial education has been maintained at the college, and large sums of money have been spent in studying methods of conducting apprentice schools and night classes in the industries. This staff, known as the Engineering Extension Division of the College, has personally organized and operated hundreds of classes in some of the best known plants in Pennsylvania, among them being manufactures of iron and steel, electrical equipment, machines and tools, automobile parts, textiles, and others common to the state. Each such enterprise was accompanied by an intensive study as to the characteristics which entered into its success or failure. The natural result has been that improved methods were continually adopted until it can now be practically assured that a company can inaugurate a general training policy with far more success than is generally believed possible.

Special text book material has been prepared for shop men. The lessons were prepared after an intensive study as to requirements and cover almost every subject which has a daily use in industry. Upward of thirty (30) lesson pamphlets have been prepared and are not only being used widely by the shops but by school boards, Young Men's Christian Association classes and other organizations having an interest in the educational welfare of their community. This lesson material is available at practically cost to any who are interested in industrial education.

Southern Metal Trades to Conduct Standardization Research

In order to improve the products manufactured by foundries and machine shops in the South that are members of the Southern Metal Trades Association, the organization is planning the appointment in the near future of a research committee that will establish certain manufacturing standards, and members of the association will be required to manufacture their products in accordance with these specifications or will not be allowed to use the trade name that the association plans to adopt. The committee, which is to be appointed by Gus F. Meehan, of Chattanooga, Tenn., president of the association, will include in its membership expert metallurgists and leading men of the foundry and machine shop industries in the Southern field.

Every member of the association wishing to use the special trade name will be required to submit samples of castings and finished products to this committee, and if these products measure up to the requisite specifications, that company will be allowed to use the trade name. The committee also will inaugurate a course for training its members in the manufacture of the very highest grade and quality gray iron castings.

Some idea of the importance of the Southern Metal Trades Association in the Southern field is contained in the recent report of William E. Dunn, Jr., of Atlanta, secretary, showing that the association represents in its membership a $50,000,000 investment in plants, foundries, machine shops, etc., with more than 25,000 employees.

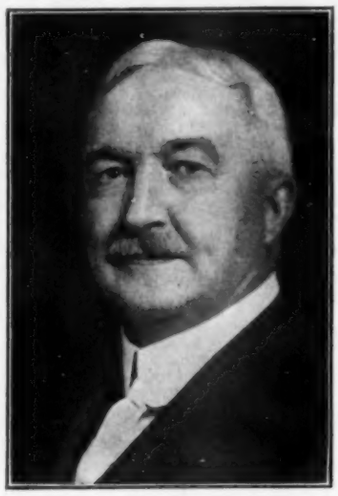
An enormous steel plant that will represent a total investment of between $8,000,000 and $10,000,000 will be established at Chattanooga, Tenn., if Henry Ford is allowed to purchase the Muscle Shoals property and develop the river shipping in this section of the Sotheast. The project was engineered by Chattanooga business men who succeeded in interesting Northern and Eastern capital. Plans and specifications of the proposed plant already have been partly completed and sent to financial interests in New York City.

It is proposed to develop a plant in which steel can be made on the one-heat basis, and by this process more economically produced. The development includes extensive iron ore and coal holdings, and the construction of furnaces. An unlimited supply of high-grade iron ore is available in that section, according to an investigation made some time ago by the United States geological survey.

Dean Cooley, of Michigan University, President of Engineering Council

The election of Mortimer Elwyn Cooley, dean of the College of Engineering and Architecture of the University of Michigan, as president of the American Engineering Council of the Federated American Engineering Societies was announced at a meeting of the Executive Board of the Council, held at the Cosmos Club, in Washington, on Sept. 30. Dean Cooley assumes office at once.

The new head of organized engineering is a past president of the American Society of Mechanical Engineers and has a long record of distinguished service in education, under the Government and in private capacities. He was born in Canandaigua, N. Y., March 28, 1855, and was graduated from the United States Naval Academy in 1878.



MORTIMER E. COOLEY

After several ocean voyages he was detailed to the University of Michigan for three years, under a law which permitted the Secretary of the Navy to detail engineer officers as professors of "Steam Engineering and Iron Shipbuilding," and thus began his long connection with the university which has been his life work and has covered a period of nearly forty years.

Mr. Cooley was vice-president of the American Association for the Advancement of Science (1898); director of the American Society of Civil Engineers (1913-1916); vice-president of the Society for the Promotion of Engineering Education (1908-09); president of the Michigan Engineering Society (1903). He became a member of the American Society of Mechanical Engineers in 1884 and served as vice-president during the year 1902-03, and in 1916-17 as chairman of the executive committee, Detroit section. During 1918-19 Dean Cooley was president of this society.

Much important business was transacted by the executive board of the council at its Washington meeting. The presiding officers were Calvert W. Townley and J. Parke Channing of New York, vice-presidents. Progress was reported in the direction of establishing a Department of Public Works.

The council adopted the report of the Committee on Patents, headed by Edwin J. Prindle of New York, urging the passage of the Lampert bill to remedy conditions in the Patent Office.

The committee opposed the passage of the Stanley Senate Bill which provides for an amendment to the Patent Act, requiring that patents to aliens be granted with a condition that unless such patents be worked in this country within two years after the granting of the patents, the government may grant licenses under them.

It was decided not to hold an engineering assembly next January. The committee in charge of the arrangements was converted into a program and entertainment committee for the annual meeting of the council, to be held in Washington in January.

The board announced the resignation as assistant secretary of A. C. Oliphant.

The board received the report of Col. A. S. Dwight, the federation's representative on the deputation of thirteen which went abroad to confer the John Fritz Medal on Sir Robert Hadfield and Eugene Schneider.

Federal Board Sees Better Steel Business

Favorable prospects for the steel industry are seen by the Federal Reserve Board. In its Oct. 1 analysis of the business situation the following appears:

"After a continuous decline since October, 1920, pig iron production showed an increase during August. The output during that month amounted to 984,193 tons, as compared with 864,555 tons during July. The respective index numbers were 41 and 37. The number of furnaces in blast remained unchanged. Steel ingot production showed a somewhat greater increase, from 803,376 tons to 1,138,071 tons. The respective index numbers were 35 and 49. This increase in output was not, however, accompanied by a similar increase in orders for advanced delivery, as the unfilled orders of the United States Steel Corporation declined from 4,830,324 tons at the close of July, corresponding to an index number of 92, to 4,531,926 tons at the close of August, corresponding to an index number of 86.

Stronger Tone

"There is now a generally stronger tone in the industry. The improvement which made its appearance in August has become somewhat more marked. This is noticeable in the case both of pig iron and of certain finished products. The demand for pig iron has broadened to some extend and more interest is displayed in contracting for future delivery. Total sales in August were the best of the year by a substantial margin and shipments in an even greater proportion. Prices hardened considerably during the latter part of August after having dropped to low levels earlier in the month, and some increases are reported during the present month. Wheras the gain in August pig iron production was due principally to the operations of steel works stacks several merchant furnaces have been blown in since the first of September. The situation with respect to finished steel products however is still uneven and conditions are unsettled. Manufacturers of certain of the lighter products, notably wire and sheets, have booked considerable tonnage and have advanced prices. In other lines, however, particularly shapes and bars, further price reductions have been made, and buyers in these lines still are willing to place orders for future delivery."

Improved Business Conditions in Germany

(H. W. Adams, representative of Department of Commerce, Berlin, Sept. 10, 1921)

The recent peace legislation in the United States has had no apparent influence on the German stock exchanges or on business conditions in general. However, with the further depreciation of the mark, business conditions have improved, resulting in a rise in the market values of cotton, potash, grain and metal products. Nevertheless, the market is weak and speculation is on the increase.

The Leipzig Fair, which ended Sept. 3, proved to be an average success, and the business done at the fair was only above average in a few commodities. Many new inventions were exhibited and special attention was given to the adaptation of former war plants to peace production.

Although shipbuilding is handicapped by the inadequacy of State compensation to shipping companies, unofficial figures show that about 400,000 tons have been added to the merchant marine during the first seven months of 1921. Vessels of less than 1,000 tons are not included in this estimate.

Unemployment Decreasing

The number of unemployed receiving public support decreased from 315,000 in July to 275,000 in August. The struggle between employer and employee over the question of increased wages is becoming more acute in spite of the fact that the employers have partially acceded to the demands of the workers. The government has granted increased wages to its employees.

The administration has declared that an increase in railway and postal rates is unavoidable. The increase in railway rates, it is estimated, will amount to 35 or 40 per cent, while an additional 60 or 70 per cent will be added to the present postage rates. The floating debt of the government on July 31 amounted to 219,000,000,000 marks, of which 190,000,000,000 marks were discounted treasury bills.

"How To Retain and Increase Export Trade"

Convention of American Manufacturers Export Association—M. W. Robinson Elected President for 1922

Taking as its general theme the thought expressed in the title above, the American Manufacturers Export Association held its twelfth annual convention at the Waldorf-Astoria Hotel, New York City, on Oct. 5 and 6. The convention was well attended, though in numbers the delegates were behind other years. The exhibition held in the Astor Gallery in conjunction with the meeting covered a wide variety of export trades and topics. Foreign shipping interests, publishers and advertisers seemed to predominate.

On the morning of the 5th the most important business was the election of officers for the ensuing year. Myron W. Robinson, president of the Crex Carpet Co., New York, was elected president, and the following as vice-presidents: H. S. Demarest, New York; J. S. Lawrence, Boston; E. M. Heinz, Chicago; Frank H. Taylor, Philadelphia; Julius Goslin, Birmingham, Ala.; V. H. Pickney, San Francisco; treasurer, Philip B. Kennedy, New York; directors to serve three years, W. S. Gavan, New York; Walter Drake, Detroit; M. A. Oudin, Schenectady; F. K. Rines, New York; E. W. Droosten, New York.

At the luncheon at noon president William C. Redfield, formerly Secretary of Commerce, presided. The speakers were Ernesto Franco, of Ecuador, and George Weston, general manager of the American Express Co. in South America.

The afternoon session was taken up with the president's address and discussions by Allen Walker, Guaranty Trust Co., on "Problems of Exchange," and by William S. Kies, Federal Foreign Banking Association, on "Foreign Credits and Investments."

In the evening Frank H. Taylor, president of the S. S. White Dental Manufacturing Co., presided. The speakers were W. F. H. Kaeloch, president of the New Netherlands Bank of New York; John S. Lawrence, Lawrence & Co., Boston, and Benjamin M. Anderson, Jr., Chase National Bank of New York. The session was devoted to a discussion of the topic, "Our Relation to the Present European Situation."

The morning session of the sixth was presided over by W. L. Saunders, of the Ingersoll-Rand Co. Speakers were John H. Fahey, of Boston, on "International Chamber of Commerce and American Interests," and Julius Klein on "Bureau of Foreign and Domestic Commerce."

American Valuation Debated

The afternoon session of this day was one of the most important of the convention. The time was devoted to a discussion—or rather a debate—on the "American Valuation Plan," which is the feature of the proposed Fordney Tariff Bill. Thomas J. Doherty, of the National Council of American Importers and Traders, delivered a scathing indictment of the American valuation plan. He traced tariff legislation back to 1789, explaining how duty was imposed then and giving what appeared to be substantial reasons why this proposed plan is not feasible at this time. Mr. Doherty spent twenty-four years in the Government customs service and impressed his audience with the idea that he knew his subject very well.

The defence of the plan was left to Judge John F. Zoller, of the General Electric Company, who, while he apparently knew his subject and gave an excellent presentation of his ideas, was quite outclassed by his opponent who had the added advantage of having the sentiment of the association with him. Judge Zoller said that the American valuation plan would enable us to attend to our own business in our own country and declared that we could not build a tariff wall high enough to keep out foreign competition.

The annual banquet in the evening was featured by an address by the Hon. Herbert Hoover, Secretary of Commerce. Mr. Hoover devoted his address to matters which would be of most vital interest to exporters. He suggested a concert of international banking resources, to which the Federal Reserve Bank in this country, the Bank of England, and the banks of Spain, Italy, France and Amsterdam would be parties, to stabilize exchange and world credits, as a means to rehabilitate the economic situation, especially in Southeastern Europe, and to restore world trade to normal.

Faith in People

Mr. Hoover held out hope of much good to come from the unemployment conference, asserting that the recommendations of the conference had been received with approval. Communities already are at work solving their individual unemployment problems, he declared, and throwing the burden of working out of the depression on to the moral courage of the people, as a whole. "It is from the great qualities of our people, rather than from the government," he added, "that our recovery will come, and with the effort of each and every one of us it will come quickly."

He reviewed some of the evidences of business recovery at hand, alluding to the increase in production of textiles, coal, iron, steel, boots and shoes, building materials and building construction.

He asserted that world stabilization is awaiting the cessation of the issue of flat money and the balancing of national budgets. He criticized the reparations agreement with Germany and stated that "better arrangement of this matter must take priority if we are to see stability in any of the European currencies."

Senator Edge on Taxation

Senator Edge, of New Jersey, advocated the elimination of the surtaxes, excess profits tax and the so-called nuisance taxes for the stimulation of industrial enterprise in this country. In their place he suggested a manufacturers' sales or turnover tax. This apparently met with the approval of most of his hearers. Approaching the tariff question, he asserted that the majority of the Senate is committed to protection, but realized that imports are as necessary to our economic well-being as are exports.

Canadian Automobile Industry

(Consul General J. I. Brittain, Winnipeg, Canada, August 26)

The automobile industry in Canada is divided into three main lines—production of automobiles, manufacture of automobile accessories, and the repair of automobiles. The total value of automobiles produced in 1919 was $80,619,846; accessory plants produced to the value of $8,571,890, and repair plants $11,991,020, making a grand total for the industry of $101,182,756.

Six thousand eight hundred and seventy-six persons found employment in plants manufacturing automobiles, for which they received wages of $9,712,788; the automobile repair plants required 3,629 employees, to whom $3,728,414 was paid. In comparing the number of employees engaged in automobile manufacturing plants and automobile repair shops, it is noted that there were only 11 manufacturing plants, while there were 1,239 shops devoted to repair work, and the latter were to a large extent individual establishments where the owner is himself a mechanic and replaces a wage earner. An important factor in the automobile repair industry is cost of materials used, which in 1919 amounted to $4,375,085, the largest proportion representing automobile parts manufactured by producers of automobiles.

Automotive Developments in Norway

(Vice Consul George Gregg Fuller, Trondhjem, Norway)

The general transportation of pleasure cars and trucks into Norway has almost come to a standstill, due to several causes, chief of which are the present abundant supply and adverse economic conditions. But this is only temporary and manufacturers may count on a fair market upon the readjustment of conditions.

In northern Norway American cars lead in popularity. From 1915 to 1920 the number of automotive vehicles registered increased 450 per cent, of which number 65 per cent were of American make. The next in point of popularity were vehicles of German make. Of the total number registered 16 per cent were German.

Norway was just beginning to use automobiles at the outbreak of the war, but it was not until 1918 that the demand grew strong. The need was met by the importation not only of new cars but of used cars, as manufacturers of the former could not meet the demand. The majority of the vehicles imported were low in price. Believing that the demand would continue, dealers did not cancel their orders for new vehicles.

Cotton Advance Aids Unemployment in South

That material progress has been made in Georgia toward relieving the unemployment situation since cotton began its advance a month ago, that there are now more persons employed in the state than at any time in the past seven months, is the substance of an announcement by Hal M. Stanley, commissioner of commerce and labor, and John Yopp, Federal labor statistician and secretary of the Georgia Manufacturers' Association. The remarkable improvement in business conditions over the state since cotton began its advance is solely responsible for the decrease in unemployment.

Every state in the Southeast has reported material improvement in the unemployment situation during the past four or five weeks.

Employment Less in Metal-Working Trades

Records compiled by the Metal Manufacturers' Association of Philadelphia show employment of metal workers in this district is less than in the 1908 and 1914 depression periods. A letter has been sent to members of the association setting forth the findings.

Surveys at those times show in man-hours in 1908 there was a decline of 44.7 per cent from normal and in 1914 a decline of 33.5 per cent. On Sept. 1 of this year the decline had reached 54.7 per cent. The percentage of unemployed in 1908 was 34.5 per cent, in 1914 27 per cent and Sept. 1, 1921, 48.8 per cent.

There are several indications of minor improvement. Demand for labor, though still slight, has increased noticeably, with some exceptions the gross number of men being released has declined. Average wage reduction at the end of August was 16.6 per cent.

Stove Makers Optimistic

That general business conditions are slowly but steadily improving in the foundries and machine shops of the South, that there will be a fair demand for foundry products during the coming winter and that the industry as a whole is rapidly approaching normal, was the consensus of opinion among the officers and delegates attending the two-day annual convention of the Southern Stove Manufacturers' Association, held at Chattanooga, Tenn., Sept. 19 and 20. Besides the members of the Southern organizations, representatives of several Northern stove plants were present. The sessions were mainly devoted to general business discussion.

New Branch Managers Appointed for Bosch Company

New managers have recently been appointed for the American Bosch Magneto Corporation at its New York and Detroit branches. George Shortmeier, formerly New York manager for the Madison Rubber Co., and later district manager at New York for the Sinclair Oil Co., has been placed in charge of the Bosch branch at New York, replacing O. S. Stanley.

Charles L. Shedd is now manager of the Bosch branch at Detroit, taking the place of Roy Davey, who has been made manager of the manufacturing sales department at Springfield, Mass. Mr. Shedd was at one time promotion manager of the truck division of the Packard Motor Car Co. at Detroit, subsequently served as official distributor at Omaha for that company and still more recently represented as sales manager the Republic Truck Corporation, at New York City.

The company has just completed a new building in the Columbus Circle district, which is now the center of automotive sales and manufacturing interests in New York. The new Bosch building, which stands at 17-19-21-23 West 60th St., has ten stories and mezzanine and is thoroughly modern in every detail. It is of fire proof construction, being built of steel, stone and concrete throughout. The corporation will occupy four complete floors. A large service station and installation garage will be located in the basement and the sales and stockroom will occupy the ground floor. It is the intention of the corporation to rent the upper floors of the building exclusively to automotive concerns, and retain an atmosphere of motordom throughout the structure.

War Doesn't Pay

In an article under the above title in the October issue of the *Nation's Business*, Pierre S. DuPont, chairman of the board of E. I. DuPont de Nemours & Co., has some interesting things to say in defense of the much abused munition worker. Some of his remarks follow.

"The popular conception of a munitions maker is a sinister individual with a deep hatred for peace and a contempt for the pursuits thereof. He is pictured as doing all in his power to fan the flames of distrust between nations and to delight in the conflicts that ensue, since they create enormous and immediate profits for [illegible] corporation.

"I called this the popular conception of the munitions maker; in reality it is the popular misconception.

"Consider the E. I. du Pont de Nemours & Co., whose history is coincident in point of time with that of the United States. We have furnished a great part of the explosives used in all the wars in which the United States has engaged. Therefore we feel that our records should show conclusively what war will do for—and to—a maker of munitions.

"No munitions concern can live by war alone. During the 139 years of the existence of the United States as a nation there were four major conflicts before the World War. They lasted about ten years in all, or about 7 per cent of the time. How could any independent corporation keep itself alive for 139 years by turning out a product that was only wanted ten years of the time?

"The manufacturer of war materials who was prepared to meet the emergencies of these years was not supported during the intervening time by preparations for the conflicts. Such manufacturers existed through the ownership of factories occupied in making peacetime products. In that way alone could they stabilize their businesses.

"Most people—business men included—probably think war has no dangers for the maker of munitions. The truth is that no one realizes as clearly as do we makers of war necessities the grave financial dangers of modern conflicts. Even for a company as strong and firmly established as our own, it is a gamble whether it can successfully weather the storm.

"I consider President Harding's move in calling the disarmament conference a long step in the right direction, as it will be held while people still have in mind the physical horrors of warfare, and while the nations still are suffering from economic wounds. Sentiment against war has always been strong; added to this sentiment now is the crushing burden of taxation, and a disarrangement of all the orderly channels of domestic and international commerce. The conference has an excellent chance to achieve the high aim for which it has been called."

Steel Exports Slowly Recovering

Reports concerning the domestic aspects of the steel industry and trade indicate a further improvement, along lines which began to appear about the end of July. As expected, the August figures for production of pig iron and steel ingots showed an upward turn from the low point touched in July, and further increases in operations to date during September strengthen the conclusion that July actually was the turning point toward better conditions. Steel export activities, however, still lag, for neither volume nor value of shipments during August shared in the increase which has been reported for total exports.

For the seventh consecutive month, August shows a new low record for exports of iron and steel from the United States, with a total of only 73,792 tons. This is the lowest point recorded since January, 1909. The course of the decline in steel exports is illustrated by the following monthly totals:

MONTHLY EXPORTS OF IRON AND STEEL, 1921

	Long Tons.
January	540,916
Februa[illegible]	393,266
Marcn	226,152
April	160,087
May	138,106
June	115,194
July	85,082
August	73,792

The total for the eight months, 1,732,595 tons, is at the rate of about 2,500,000 tons for the year; but that figure makes no allowance for the very low level reached in recent months, from which an unexpected sharp and extensive recovery would be necessary to carry the annual total to any such figure. As a matter of fact, the present outlook for exports during the balance of the year holds little or no prospect for a larger tonnage than that of the past four months. Even if the volume exported from May to August, inclusive, is duplicated in the last four months of the year, the annual total will fall short of 2,150,000 tons, or only a little more than 40 per cent of the tonnage exported in 1920.

The rank of the various items in the list during August was as follows:

AUGUST EXPORTS OF IRON AND STEEL PRODUCTS

	Long Tons
Steel sheets	14,170
Wrought pipe	10,537
Structural steel	9,852
Steel plates	9,388
Steel bars	5,180
Rails	4,782
Cast pipe	2,931
Tin plate	2,646
Billets, etc.	2,447
Pig iron	2,419
Galvanized sheets	2,353
Hoop and band	1,386
Wire Nails	1,113
Plain wire	1,077
Bolts, nuts, etc.	1,024
Barbed wire	974
Iron sheets and plates	457
Wire rods	351
Iron bars	257
Nails (not wire or cut)	219
Railroad spikes	196
Ship & tank plate	25
Cut nails	6
Total	73,792

As compared with the rank in July, (see weekly Commercial Reports, September 5, 1921), rails show a very sharp decline of more than 15,000 tons, and sheets a pronounced increase of more than 7,000 tons, and as a result of these changes rails dropped from first to sixth place, while sheets moved from fourth place to the top of the list. Wrought pipe and structural steel continue in the same relative positions, with more moderate declines than noted for rails.

Japan A Big Buyer

Among the leading tonnage items the larger exports of sheets were due to marked increase in shipments to Japan, upward of 20 per cent of the total going to that market. Plates also were taken largely by Canada and Japan, with only small lots to other countries. Shipments of wrought pipe and structural steel, on the other hand, were more widely distributed in sizable amounts.

The rank of the principal markets is considerably different for August trade from that reported for July, the leading countries being as follows:

PRINCIPAL MARKETS FOR AUGUST EXPORTS OF STEEL

	Long Tons
Canada	25,967
Japan	16,534
Mexico	6,755
British India	6,086
Cuba	2,249
Honduras	2,046
United Kingdom	1,779
Argentina	1,554
Australia	1,192
Brazil	1,072
Philippine Islands	1,064
Rumania	1,017

The twelve countries account for more than 90 per cent of the total exports for the month, and with two exceptions they are normally among the chief markets for steel from the United States. It is also interesting to note that Japan again stands second, partly as the result of the larger shipments of sheets already mentioned, and partly as a result of smaller movement to Mexico. China and Dutch East Indies, which were prominent in the July list, have dropped behind, while British India and Argentina have moved forward.

For Canada, Japan and the Philippines the leading items of trade were plates, sheets and structural steel. For Brazil and Honduras rails were the chief factor, and for all the others pipe ranked as the leading product. In general, the details of exports during August suggest a considerable preponderance of small scale merchant buying rather than sales of large lots of material for public works or new enterprises.

French Steel Output

Commenting on the drop in steelwork in France during the last month, *La Revue de France* calls attention to the fact that before the war France produced 10,000,000 metric tons of steel annually, whereas it can use at home scarcely half that quantity. Hence it is a simple necessity for it to export some 5,000,000 tons a year. This fact must be taken into account in determining the price at which it can and must sell its products, necessitating a cut in prices considerably below the present.

Other considerations are to be taken into account, such as the low cut in German prices and "the formidable American production" of automobiles, etc.

Comparing the figures of July, 1921, with those of 1920, of the ten principal automobile works of France, it is noted that there is a general loss of from 24 to 68 per cent of output.

Under these conditions it will be difficult for France to equal its pre-war record of 350,000,000 francs annual export of steel manufactured articles.

Newcastle Iron Works, South Africa

From the *Natal Mercury*, July 5, 1921

Just alongside the main line near Newcastle, about half a mile from the township and approximately halfway between Durban and Johannesburg, a large block of buildings and towerlike structures are nearing completion. They are the premises of the Newcastle Iron and Steel Works, Ltd., and their erection represents over two years' arduous labor. In about three months' time it is hoped to have the works and plant ready for commencing the manufacture of pig iron on a big commercial scale. The opening of the works will mark an important step in the history of industrial South Africa, and more particularly Natal. Previously, practically all the iron and steel used in this country was imported from overseas, but now, thanks to the enterprise of the promoters of the company, the iron required in the Union will be made in Natal, and there may be a surplus for export. Later on, when the molding plant has been installed at the Newcastle works, iron and steel girders, joists, pipes, and other articles will be manufactured from the pig iron turned out at the works. The output of pig iron will be approximately 150 tons per day, and the plant will be continually in operation.

Commerce Bureau Can Help You

What is the Bureau of Foreign and Domestic Commerce doing to aid American industry? This question is answered by Dr. Julius Klein, head of the Bureau, in *Forbes Magazine* (N. Y.) "The major change—one of policy that business men in general will appreciate to the full," he says, "is that the bureau has been made the home of commodity experts. The old idea that the director and a few assistants were qualified to keep sufficiently informed of the peculiar needs and problems of each of our commodity lines, has been thrown into the discard. Instead, the policy now is to have in the bureau someone who from experience knows the language, the needs, the problems, and the ambitions of each American commodity group.

"In other words, it is realized that though in the nature of the situation we can scarcely expect all our foreign representatives to be commodity experts in all lines, it is therefore all the more desirable to have at the switchboard in Washington at least one expert for each commodity line. Obviously without such experts at home we could not expect to get the best results from our force in the field.

"And, even if we got the best trade information available, there was, generally speaking, no one in the Bureau who could interpret that information adequately.

"Therefore to meet and to interpret the needs and the opportunities of the hour, the bureau is going to the limit of its appropriations, and is asking for more, to establish commodity divisions. Each of these divisions is headed by a commodity expert of long experience, who is expected to spend at least half of his time keeping in personal touch away from Washington with the trade he represents. The divisions already established cover the following commodity lines: Iron and steel, lumber, heavy machinery, electrical goods, foodstuffs, automobiles, fuels, textiles, shoes, leather, implements and vehicles, rubber goods, paper, and specialties.

"And thirty more are planned for next year."

Book Reviews

AIRCRAFT YEAR BOOK, 1921. 330 pages, 6 x 9 in., 36 illustrations. Published by Small, Maynard & Co., Boston, Mass.

While we all feel that the airplane has been neglected in this, the country where it first had practical demonstration, it is somewhat encouraging to see what has been actually accomplished. There are many pages of data as to notable flights which have taken place, but more than that, the book shows records of everyday flying, of which the average citizen knows nothing. These figures show that over 450 planes are used in commercial passenger carrying at an average charge of 65 cents per mile for intercity flights. Over 115,000 passengers and over 41,000 lb. of baggage were carried in one year, flying a distance of more than 3,000,000 miles. The mail airplanes fly 8,000 miles every day and the coast to coast mails now save from 24 to 42 hr. from New Yory to San Francisco.

About forty-five pages are devoted to outline drawings of planes which show the development from the Wright Brothers glider to the present time. These are particularly interesting. The illustrations in the rest of the book are all excellent halftones and many of them are of more than usual interest. Considerable space is given to the U. S. Air Service and much useful data as to mail carried and its cost is also to be found here. Anyone interested in the future development of aviation should have a copy of this book.

Cylinder Regrinding. By L. A. Hastings; published by the Heald Machine Co., Worcester, Mass. Known as Bulletin No. 515, 6 x 9-in., paper covers.

This is a treatise on the business of regrinding automobile cylinders. It includes much valuable information on regrinding processes, machine operation, methods of getting work and general information on the subject. The book is effusively illustrated with halftones, line cuts, charts and tables.

Chapter headings are: Cylinder Grinding—Its Possibilities and Advantages; Equipment Required; Why Motors Should Be Reground; Kinks that Will Help; Operation of Heald Cylinder Grinding Machines; Advertising; Assembling the Motor; General Information and Summary.

The book can be purchased from the Heald Company for fifty cents.

Business Letter Writing. By Alexander M. Candee. Three hundred forty-seven 6 x 9 in. pages, blue cloth boards. Published by the Biddle Publishing Co., 19 W. 44th St., New York City.

Some of the major subjects taken up are: The Business of Letter-Writing; Means for Conveying the Thought; the Principles of Thinking; Punctuation; Building the Letter; Sales Letters; Complaints and Adjustments; Credit Letters; Collection Letters. The author goes into great detail in putting his message across, not omitting information on the minor points about which so many letter-writers are uncertain.

The book will be found to be an excellent check for those who habitually write good letters. To the novice or to one who has never made any attempt to analyze letter-writing it should prove to be a very valuable guide.

Railroad Shop Practice. By Frank A. Stanley; McGraw-Hill Book Co. Inc., 370 Seventh Avenue, New York. Three hundred and thirty-one 6x9-in. pages, 391 illustrations. Price $4.

This book goes into the details of principal railroad-shop repair work, and is written by a practical man who has had special privileges to note and record the various practices of many large railroad shops in different parts of the United States.

Among the subects covered are: Operations on locomotive cylinders, pistons and piston rings; piston valves, cages and rings; tools for crossheads and guides; connecting-rod operations; driving boxes, shoes and wedges; eccentric links and tumbling shafts; frame work; driving wheels and axles; wheel shop eqiupment and methods; pipe joints; tools for valves and fittings; portable tools; special tools; air pumps and air-hose couplings; blacksmith shop equipment and work; boiler and flue work; welding operations; reclamation work; handling materials.

Business Items

The Motors Accessories Corporation has been organized at Georgetown, Del., to manufacture automobile parts. Capital stock is $200,000.

The Raleigh Motors Corporation has taken possession of its recently acquired plant at Reading, Pa., and will begin the manufacture of the Raleigh car as soon as the equipment is arranged.

The Way-Cleanse Corporation, Syracuse, N. Y., has completed a deal for the plant of the M. L. Oberdorfer Brass Corporation in that city. Machinery and raw materials now at Sandusky, O., will be moved to Syracuse at once. The Way-Cleanse Corporation has an authorized capital of $5,000,000, of which $1,500,000 is in 8 per cent preferred stock and $3,500,000 in common.

The Valley Foundry Co., of Cumberland, R. I., has recently been incorporated with a capital stock of $50,000 to manufacture machinery, etc. The incorporators are Frank Gross, M. M. McKenna and W. I. Sims.

The Verto Products Co., of Pawtucket, R. I., has recently been incorporated and organized under the laws of Rhode Island, to engage in the manufacture of machinery, etc. The capital stock of the concern is $200,000; the incorporators are Darius Gog, W. F. Stanton and William E. White.

The Hutchinson Hardware Co., of Lynn, Mass., has recently been incorporated with a capital stock of $125,000 to deal in hardware, mill supplies, etc. Henry O. Silsbee, is the president; William G. Neale, is treasurer.

According to newspaper reports from Mexico City, Elbert M. Gary, chairman of the board of directors of the United States Steel Corporation, prior to his departure from Mexico City on Sept. 20, entered into negotiations for the purchase of the properties of the Monterey Iron and Steel Foundry Co., the largest in the Republic of Mexico.

The Peerless Wire Fence Co., of Adrian, Mich., has purchased the plant of the Bosworth Bag Co., in Memphis, Tenn., and will remodel it to suit its own production.

The Syracuse plant of the Crucible Steel Co., of America resumed operations in all departments on Oct. 3. E. I. French, general manager, said that enough new orders were being received to warrant this action.

The Clark-Turner Piston Co., of Los Angeles, Cal., has made arrangements with several distributors for handling its line of Delux pistons for all kinds of motors. At the present writing the following firms have been appointed; Kansas City Motor Parts Co., Bently & Diehl Bros., Freeport, Ill., and the Westervelt Machine Corporation, New York City.

The Gilbert & Barker Manufacturing Co., West Springfield, Mass., has adapted a schedule of four days a week. This plan supersedes a proposed shut down of two months.

The Airship Construction and Navigation Corporation has been organized at Dover, Del., and capitalized at $5,000,000. The company will manufacture and sell airships and dirigibles.

The Baker-Skelton Co. has been organized in Syracuse, N. Y., by the merging of the Chapin & Baker Manufacturing Co. with the Skelton Tool Co. The Chapin & Baker Co. was formed several years ago to produce machine tools of special and standard design. The Skelton Tool Co. was engaged in a similar line of work. The offices of the merged concern will be located in Syracuse.

The S-P Manufacturing Co., a Cleveland corporation, has purchased the former American Air Chuck Co. of Chicago, Ill., and has acquired all of the patents, good will, tools, etc., of the latter company. The work of re-establishing the business is already under way and with the aid of J. A. Olson, inventor of the American air chucks, collets, vises, etc., who will be associated with The S-P Manufacturing Co. The regular business of The S-P Manufacturing Co. has consisted of the design and manufacture of special machinery, fixtures, jigs, tools, etc., which line will be continued.

Kearney & Trecker Co., of Milwaukee, Wis., announces that on and after Oct. 1 of this year, its New York branch office will be located in Room 371, Hudson Terminal Building, 50 Church St., New York City, having moved to this location from 1801 Singer Building.

Reorganization of the Locomobile Company, automobile manufacturer, with a plant at Bridgeport, Conn., was reported in New York last week. Coincident with the announcement that Elmer H. Havens of Bridgeport had been elected president, the company said that it had terminated its contract with Hare's Motors, Incorporated, under which it has been operating its properties for the last eighteen months. Continued operation of the Bridgeport plant upon a limited output, together with the approval of a new schedule of prices for its product, were contained in the company's announcement.

Fay & Scott, manufacturers of lathes at Dexter, Maine, have resumed production in their plant on a full-time basis.

The Du Pont Company has announced several changes in its executive forces. Vice-presidents A. Felix Du Pont, J. B. Edge, C. A. Patterson and C. A. Meade have resigned from the executive committee. Vice-presidents H. F. Brown and F. G. Tallman have resigned from the finance committee and are now members of the executive committee.

The Treco Metal Products Corporation has been organized in New York City, to manufacture motors and engines. Capital stock is $25,000.

The Ersted Machinery Manufacturing Co., Portland, Oregon, has purchased the foundry, machine shop and pattern shop buildings and equipment of the Pacific Iron Works in that city. Production of the Ersted machines will be continued on a larger scale with the new facilities thus obtained.

Personals

A. F. Orcutt has resigned as general manager of the Rivett Lathe and Grinder Co., Brighton, Boston, Mass.

A. E. Magnell, for the past four years publicity manager of the New Britain Machine Co., New Britain, Conn., has severed his connections with that company. Mr. Magnell has several plans under consideration for the future, but as yet has made no definite connection.

Obituary

Andrew G. Young, general traffic manager of the American Sheet and Tin Plate Co., died on Sept. 29 in Cleveland, Ohio. Since the end of the war Mr. Young had lived in Pittsburgh. During the war he was in charge of the allocation of steel to the shipyards and had his office in New York. He had been connected with the American Sheet and Tin Plate Co. for more than twenty years. He was 62 years old.

William Kemp, formerly general manager of the J. B. Carr Chain Works, Troy, N. Y. died on Sept. 30 at Elmhurst, L. I., N. Y.

Forthcoming Meetings

The American Gear Manufacturers Association will hold its semi-annual meeting at Rochester, N. Y., October 13, 14 and 15. F. D. Hamlin, 4401 Germantown Ave., Philadelphia, Pa., is secretary.

The National Machine Tool Builders' Association will hold its fall meeting at the Hotel Astor, New York City, October 18, 19 and 20.

There will be a meeting of the Machine Tool Section of the National Supply and Machinery Dealers' Association in the Hotel Astor, New York City, on Wednesday, Oct. 19, at ten o'clock in the morning. Thomas Fernley, 505 Arch St., Philadelphia, Pa., is secretary.

The annual convention of the Industrial Relations Association, of America, will be held in the Waldorf-Astoria Hotel, New York City, on Nov. 1, 2, 3 and 4.

The National Conference of the Industrial Cost Association will be held at Pittsburgh, Pa., on Nov. 2, 3 and 4.

The third annual convention and exhibition of the American Gas Association will be held in the Congress and Auditorium Hotels, Chicago, Ill., on Nov. 7 to 12.

The Weekly Price Guide

This Week's Market

The Pittsburgh mill price of $1.75 for structural steel shapes and plates and $1.65 per 100 lb. for bars continues in effect. Business has been done, however, as low as $1.60@$1.65 for shapes and plates and $1.60 per 100 lb. for bars. Mill shipments, New York, of shapes and plates are quoted at $1.98@$2.13; bars at $1.98@$2.03 per 100 lb. New York warehouses have advanced the price of black and galvanized steel sheets 25c. per 100 lb.

Zinc and electrolytic copper have advanced ¼c. per lb. in New York and St. Louis. Antimony has gone up ¼c. in New York and ½c. per lb. in Chicago. Both New York and Chicago report a rise of 1c. per lb. on copper sheets, bars, wire and tubing. Advances ranging from ½c. to 1½c., in old metals, are reported in New York and a rise of ¼c. per lb. in Chicago.

Linseed oil is quoted at 73c. as against 76c. in New York and at 81c. as against 87c. in Chicago.

IRON AND STEEL

PIG IRON — Per gross ton — Quotations compiled by The Matthew Addy Co.:

CINCINNATI	
No. 2 Southern	†$24.50
Northern Basic	†22.52
Southern Ohio No. 2	†23.52
NEW YORK—Tidewater Delivery	
Southern No. 2 (Silicon 2.25 to 2.75)	†30.26
BIRMINGHAM	
No. 2 Foundry	†20.00
PHILADELPHIA	
Eastern Pa., No. 2x, 2.25-2.75 sil	†22.76
Virginia No. 2	†28.74
Basic	†20.75
Grey Forge	†21.75
CHICAGO	
No. 2 Foundry local	†22.70
No. 2 Foundry, Southern, sil 2.25@2.75	†26.66
PITTSBURGH, including freight charge from Valley	
No. 2 Foundry	†22.96
Basic	†21.96
Bessemer	†21.96

*F. o. b. furnace. † Delivered.

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the base quotations from mill:

Blue Annealed	Pittsburgh, Large Mill Lots	New York	Cleveland	Chicago
No. 10	2.50	3.28	3.10	3.38
No. 12	2.60	3.33	3.15	3.43
No. 14	2.70	3.38	3.20	3.48
No. 16	2.80	3.48	3.30	3.58
Black				
Nos. 17 and 21	2.85	4.05	3.55	3.95
Nos. 22 and 24	2.90	4.10	3.60	4.00
Nos. 25 and 26	2.95	4.15	3.65	4.05
No. 28	3.00	4.25	3.75	4.15
Galvanized				
Nos. 10 and 11	3.00	4.25	3.75	4.15
Nos. 12 and 14	3.10	4.35	3.85	4.25
Nos. 17 and 21	3.40	4.65	4.15	4.55
Nos. 22 and 24	3.55	4.80	4.30	4.70
No. 26	3.70	4.95	4.55	4.85
No. 28	4.00	5.25	4.75	5.15

WROUGHT PIPE—The following discounts are to jobbers for carload lots on the Pittsburgh basing card of Sept. 16, 1921:

BUTT WELD

Steel Inches	Black	Galv.	Iron Inches	Black	Galv.
1 to 3	68½	56	¼ to 1¼	39½	24½
LAP WELD					
2	61½	49	2	34½	20½
2½ to 6	65½	53	2½ to 4	37½	24½
7 to 8	62½	49	4½ to 6	37½	24½
9 to 12	61½	48	7 to 12	35½	22½
BUTT WELD, EXTRA STRONG, PLAIN ENDS					
1 to 1½	66½	55	1 to 1½	39½	25½
2 to 3	67½	56			
LAP WELD, EXTRA STRONG, PLAIN ENDS					
2	59½	48	2	35½	22½
2½ to 4	63½	52	2½ to 4	38½	26½
4½ to 6	62½	51	4½ to 6	37½	25½
7 to 8	58½	45	7 to 8	30½	18½
9 to 12	52½	39	9 to 12	25½	13½

Malleable fittings. Classes B and C, Banded, from New Yorl stock sell at net list. Cast iron, standard sizes, 20–5% off.

WROUGHT PIPE—Warehouse discounts as follows:

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv.
1 to 3 in. steel butt welded	60%	46%	60½%	47½%	68½%	56%
3½ to 6 in. steel lap welded	51%	37%	58½%	44½%	65½%	53%

Malleable fittings. Classes B and C, Banded, from New York stock sell at list less 5%. Cast iron, standard sizes, 32% off.

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Open hearth spring steel (heavy)	5.00	6.00	8.25
Spring steel (light)	6.00	6.00	10.50
Coppered Bessemer rods (base)	8.00	8.00	6.03
Hoop steel	3.88	3.29	3.48
Cold rolled strip steel	7.50	8.25	7.25
Floor plates	4.85	2.74	5.23
Cold finished shafting or screw	4.03	3.50	4.00
Cold finished flats, squares	4.53	4.00	4.50
Structural shapes (base)	2.88	2.74	2.88
Soft steel bars (base)	2.78	2.64	2.78
Soft steel bar shapes (base)	2.78	2.64	2.78
Soft steel bands (base)	3.43	....	.....
Tank plates (base)	2.88	2.92½	2.88
Bar iron (2.15@2.25)	2.78	3.52	2.78
Drill rod (from list)	55@60%	55%	50%

Electric welding wire..... New York $\frac{5}{32}$, 8½c. per lb. ⅛—7.15c.; $\frac{5}{32}$ to ¼—6.75c. Swedish iron sells at 18½c. per lb. in Chicago

METALS

Current Prices in Cents Per Pound

	New York	Cleveland	Chicago
Copper, electrolytic (up to carlots), New York			13.37½
Tin, 5-ton lots, New York			27.25
Lead (up to carlots), St. Louis, 4.60; New York			5.00
Zinc (up to carlots), St. Louis, 4.97½; New York			5.37½
Aluminum, 98 to 99% ingots, 1-15 ton lots	25.00	25.00	21.00
Antimony (Chinese), ton spot	5.50	6.00	6.50
Copper sheets, base	20.75	20.50	20.50
Copper wire (carlots)	16.50	15.50	15.50
Copper bars (ton lots)	19.00	22.00	18.00
Copper tubing (100-lb. lots)	20.50	22.00	20.50
Brass sheets (100-lb. lots)	15.25	17.00	15.25
Brass tubing (100-lb. lots)	18.00	18.00	18.00
Brass rods (1,000-lb. lots)	13.25	15.00	13.25
Zinc sheets (casks), (8% dis. carlots)	11.00	11.15	15.75
Nickel (ingot and shot), Bayonne, N. J.	41.00	.....	.....
Nickel (electrolytic), Bayonne, N. J.	44.00	.....	.....
Solder (½ and ½), (case lots)	19.50	23.50	17.50
Babbitt metal (best grade)	70.00	37.50	32.00
Babbitt metal (commercial)	30.00	13.50	8.00

—Shop Materials and Supplies

MONEL METAL—Base price in cents per lb., f.o.b. Bayonne, N.J.:

Shot	35.00	Hot rolled machined rods (base)	53.00
Blocks	35.00	Hot rolled rods (base)	42.00
Ingots	38.00	Cold drawn rods (base)	56.00
Sheet bars	40.00	Hot rolled sheets (base)	55.00

SPECIAL NICKEL AND ALLOYS—Price in cents per lb.

Malleable nickel ingots	45
Malleable nickel sheet bars	47
Hot rolled rods, Grades "A" and "C" (base)	60
Cold drawn rods, Grade "A" and "C" (base)	72
Copper nickel ingots	37
Hot rolled copper nickel rods (base)	45
Manganese nickel hot rolled (base) rods, "D"—low manganese	64
Manganese nickel hot rolled (base) rods "D"—high manganese	67

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Copper, heavy, and crucible	10.00	9.00	10.25
Copper, heavy, and wire	9.50	9.00	9.50
Copper, light, and bottoms	8.00	7.00	8.00
Lead, heavy	4.00	3.00	3.75
Lead, tea	3.00	2.00	3.00
Brass, heavy	6.50	5.00	8.00
Brass, light	5.00	3.00	4.75
No. 1 yellow brass turnings	5.25	4.00	5.25
Zinc	3.00	2.00	2.75

TIN PLATES—American Charcoal Plates—Bright—Cents per lb.

		New York	Cleveland	Chicago
"AAA" Charcoal Melyn Grade:				
IC,	20x28, 112 sheets	21.50	.....	.....
IX,	20x28, 112 sheets	24.00	.....	.....
IXX,	20x28, 56 sheets	13.75	.....	.....
IXXX,	20x28, 56 sheets	15.50	.....	.....
IXXXX,	20x28, 56 sheets	17.00	.....	.....
"A" Charcoal Allaways Grade:				
IC,	20x28, 112 sheets	18.50	.....	.....
IX,	20x28, 112 sheets	21.50	.....	.....
IXX,	20x28, 56 sheets	12.25	.....	.....
IXXX,	20x28, 56 sheets	14.00	.....	.....
IXXXX,	20x28, 56 sheets	15.75	.....	.....
Coke Plates, Bright				
Prime, 20x28 in.:			(56 sheets)	
80-lb,	112 sheets	13.60	.....	.....
90-lb.,	112 sheets	13.80	.....	.....
100-lb.,	112 sheets	14.00	6.50	.....
IC,	112 sheets	14.30	6.65	.....
IX,	112 sheets	16.30	.....	.....
IXX,	56 sheets	9.15	.....	.....
IXXX,	56 sheets	10.15	.....	.....
IXXXX,	56 sheets	11.15	.....	.....
Terne Plate				
Small lots, 8-lb. Coating:				
100-lb.,	14x20	7.50	6.25	6.25
IC,	14x20	7.75	6.50	6.50

SHOP SUPPLIES

	New York	Cleveland	Chicago
Machine Bolts:			
All sizes up to 1x30 in.	—50%	—60%	—60-5%
1⅛ and 1¼x3 in. up to 12 in.	—40%	60-10-10%	—55%
With cold punched sq. nuts	—30%	.....	....
With hot pressed hex. nuts up to 1x30 in. (plus std. extra of 10%)	—40%	.....	.....
Up to 1-in. diameter, with cold punched hex. nuts (plus std. extra of 10%)	—30%	.....	.....
Button head bolts, with hex. nuts	—20%	$3.90 base	.....
Hex. head and hex. nut bolts	—20%	.....	.....
Lag screws, coach screws	—50-10%	.....	.....
Carriage bolts, all sizes up to 1 in. x 30 in.	—45%	50-10-10%	50-5%
Bolt ends, with hot pressed nuts	—50%	.....	.....
Tap bolts, hex. heads	—20%	.....	.....
Rivets, $\frac{7}{16}$ in. dia. and smaller. *New list*	-50-10%	60-10-10%	-60-10%
Rivets, tinned	-50-10%	60-10-10%	—45%
Semi-finished nuts, all sizes	—70%	75%	50%
Case-hardened nuts	—60%	.....	.....
Washers, cast iron, ½ in., per 100 lb.	$5.00	$5.50 off	$4.50
Washers, cast iron, ⅝ in. and larger, per 100 lb	4.25	3.75 off	4.50
Washers, round plate, off list per 100 lb.	3.00	.....	.....
Nuts, hot pressed, sq. Off list	2.00	3.00	3.00
Nuts, hot pressed, hex. Off list	2.00	3.00	3.00
Nuts, cold punched, sq. Off list	1.50	3.00	3.00
Nuts, cold punched, hex. Off list	1.50	3.00	3.00
Rivets:			
Button heads ¾-in., ⅞-in., 1x2 in. to 5 in., per 100 lb	$3.70	3.50	3.68
Cone heads, ditto	3.80	3.60	3.78
1⅛ to 1¾-in. long, all diameters, *EXTRA* per 100 lb	0.25	.....	.....
⅞ in. diameter *EXTRA*	0.15	.....	.....
½ in. diameter *EXTRA*	0.50	.....	.....
1 in. long, and shorter *EXTRA*	0.50	.....	.....
Longer than 5 in. *EXTRA*	0.25	.....	.....
Less than 200 lb. *EXTRA*	0.50	.....	.....
Countersunk heads. *EXTRA*	0.35	.....	.....
Copper rivets	50-10%	40-10%	40%
Copper burs	25-10%	15%	15%

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	$0.07½@$0.10	$0.12	$0.12
Cotton waste, mixed, per lb.	.055@.09	.09	.10
Wiping cloths per M., 13¼x13¼	.....	55.00	55.00
Wiping cloths per M., 13¼x20½	.....	65.00	65.00
Sal soda, 100 lbs	2.10	3.00	2.65
Roll sulphur, 2-bbl. lots per 100 lb	2.55	3.25	2.75
Linseed oil, per gal., 5 bbl. lots	.73	.88	.81
White lead, dry or in oil	100 lb. kegs.	New York, 12.25	
Red lead, dry	100 lb. kegs.	New York, 12.25	
Red lead, in oil	100 lb. kegs.	New York, 13.75	
Fire clay, per 100 lb		.80	.80
Coke, prompt furnace, Connellsville	per ton	$3.25@3.50	
Coke, prompt foundry, Connellsville	per ton	4.25@4.75	

NEW *and* ENLARGED

Machine Tools and Machinery Wanted

Machine-tool wants published without charge

Conn., Bristol—A. Garrigus—one 30 in. open side planer, one horizontal boring mill with 2½ or 3 in. bar and several 18 in. lathes with 8 ft. bed.

N. Y., Mattituck—T. F. Hutchings, Box 323—one gap lathe, one grinder and one arbor press for use in garage.

N. Y., New York—The Axle Lock Co., 119 East 129th St.—one turret lathe.

N. Y., New York—New York Central R.R., Grand Central Terminal—one 28 in. shaper, one 4 ft. radial drill, one triple head bolt cutter, one 16 in. and one 30 in. lathe.

N. Y., Staatsburgh—G. W. Kidder—One 437 B combination band and circular saw sharpener.

Ky., Maysville—The Maysville Machine Co., P. O. Box 288—one LaPointe broaching machine (used).

Mich., Detroit—E. Gray, Grayhaven, foot of Continental Ave.—equipment for the repair of boats and engines.

Wis., Wausau—The Bd. Educ, c/o S. B. Tobery, Supt.—machines and equipment for vocational department of Central School.

Mo., St. Louis—Uradia Co., 621 Merchants Laclede Bldg., W. E. Perryclear, Purch. Agt.—one blow torch, hack saw and small lathe.

Que., Montreal—The Wonder Tractor Co., Ltd., 234 Grand Blvd., L. Heald, Mgr.—equipment for tractor factory.

Pa., Allentown—The M. & G. Co.—general ice and ice cream machinery.

Pa., Philadelphia—O. Nebel, 3860 Coral St.—knitting machines for proposed factory on 5th and Courtland Sts.

Wis., Peshtigo—J. L. Chudacoff—knitting and special machinery for proposed knitting mill on Thompson St.

Metal Working Shops

NEW ENGLAND STATES

Mass., Boston—H. Frank, 819 Shawmut Ave., will construct a 1 story, 75 x 221 ft. garage and store building on Shawmut Ave. Estimated cost, $50,000.

MIDDLE ATLANTIC STATES

N. J. Trenton—The McFarland Fdry. & Machine Co., Willow St., has awarded the contract for the construction of a 2 story, 50 x 52 ft. addition to its foundry on New York Ave. Estimated cost, $10,000.

N. J., West New York — C. E. and I. Cuneo, 23 Fulton Ave., Jersey City, have awarded the contract for a 100 x 100 ft. garage on Hudson Ave., between 8th and 9th Sts. Estimated cost, $59,000.

SOUTHERN STATES

W. Va., Fairmont — A. B. Knight has awarded the contract for the construction of a 2 story machine shop on East Park Ave., East Side.

MIDDLE WEST STATES

Ill., Sterling—P. W. Kempster is having ing plans prepared for the construction of a 1 story, 50 x 142 ft. garage. Estimated cost, $40,000. Architect's name withheld.

Ill., Zion—Zion Institutions & Industries, c/o W. H. Glendinnen, Mgr., Administration Bldg., is having plans prepared for the construction of a 1 story, 100 x 140 ft. garage. Estimated cost, $50,000. Architects name withheld.

O., Alliance—The Alliance Machine Co., South Mahoning Ave., plans to construct a one and a half story, 50 x 250 ft. forge plant. Estimated cost, $100,000.

O., Canton — The Amer. Mine Door Co., 9th and Robin St., S. E., has awarded the contract for the construction of a 1 story, 50 x 150 ft. factory. Estimated cost, $75,000.

Wis., Madison—The University of Wisconsin will soon award the contract for the construction of an addition to its service building. A. Peabody, Capitol, State Archt.

Wis., Milwaukee — A. C. Eschweiler, Archt., 141 Wisconsin St., is receiving bids for the construction of a 1 story, 120 x 120 ft. garage on Mason and Van Buren Sts., for the Dort Motor Co., 242 4th St. Estimated cost, $40,000. Noted Sept. 29.

Wis., Milwaukee—Hanson & Phillips, Kinnickinnic Ave. and Logan St., are receiving bids for the construction of a 1 story, 100 x 100 ft. garage on Kinnickinnic Ave. Estimated cost, $40,000. Private plans.

WEST OF THE MISSISSIPPI

Mo., St. Louis—The United Railway Co., c/o A. Perkins, Mgr., 39th St. and Park Ave., is having plans prepared for the construction of a 3 story office and repair shop on Taylor St. and Bway. Estimated cost, $160,000. A. M. Arhelger, care of owner, Archt.

Neb., Omaha—The Billinger Dental Co., c/o B. P. Billings, Mgr., 17th and Douglas Sts. is having plans prepared for the construction of a 3 story, 50 x 108 ft. factory at 1804 Capitol Ave., for the manufacture of dental supplies. Estimated cost, $80,000. C. W. Steinbough, Brandies Theater Bldg., Archts.

CANADA

Ont., Toronto—The Bd. Educ., 155 College St., will soon award the contract for the construction of a 1 and 3 story technical school in Riverdale. Estimated cost, $800,000.

General Manufacturing

NEW ENGLAND STATES

Mass., Somerville—Masury-Young Co., 196 Milk St., Boston, has awarded the contract for the construction of a 3 story, 36 x 75 ft. oil testing and storage building on Rollins St. Estimated cost, $40,000.

MIDDLE ATLANTIC STATES

N. Y., Utica—The State Hospital Comn., Albany, will soon receive bids for the construction of a 70 x 110 ft. cold storage building. Estimated cost, $130,000.

Pa., Allentown—The M. & G. Co. has awarded the contract for the construction of a 3 story, 134 x 156 ft. and a 2 story, 50 x 112 ft. ice cream factory. Estimated cost, $500,000.

Pa., Johnstown—Peris Soap Products Co., South Sheridan St., plans to build a 3 story, 80 x 320 ft. soap factory on South Sheridan St. Estimated cost, $150,000.

Pa., Philadelphia—O. Nebel, 3860 Coral St., has awarded the contract for the construction of a 3 story, 58 x 215 ft. knitting mill on 5th and Cortland Sts. About $100,000.

Pa., Pittsburg—Fried & Reineman Packing Co., 1314 Spring Garden Ave., has awarded the contract for the construction of a 2 story, 40 x 70 ft. packing plant. Estimated cost, $50,000.

Pa., Wilkes Barre—Hess-Goldsmith, 239 4th Ave., New York City, has awarded the contract for the construction of a 1 story silk mill on Ash St. and Darsey Lane. Estimated cost $165,000.

SOUTHERN STATES

N. C., Raleigh—R. S. Busbee, chn. State School for Blind, will receive bids until Oct. 25 for the construction of a group of buildings including laundry, etc., on the campus. Estimated cost, $200,000. J. A. Salter, Commercial Bank Bldg., Archt.

MIDDLE WEST STATES

Mich., Grand Rapids—The Grand Rapids Show Case Co., Ottawa Ave. and Coldbrook St., N.W., has had plans prepared for the construction of a 5 story, 102 x 132 ft. factory for the manufacture of show cases. Estimated cost $75,000. H. L. Mead, Grand Rapids, Archt.

O., Cleveland — The Snearer Furniture Co., 10022 Euclid Ave., has awarded the contract for the construction of a 2 story, 30 x 32 ft. addition to its factory. Estimated cost, $15,000.

O., Piqua—The Valdecker Packing Co., Piqua, is receiving bids for the construction of a 2 story, 29 x 49 ft. addition to its packing plant. Estimated cost, $40,000. Anders & Reimers, Erie Bldg., Cleveland, Archts. and Engrs.

Ohio, Uhrichsville—Uhrichsville Knitting Mills Co. has awarded the contract for the construction of a factory at junction of Pennsylvania R.R. company's property and North Water St. Estimated cost $35,650.

Wis., Merrill—The Merrill Wood Products Co., Merrill plans to build a 2 and 3 story, 60 x 100 ft. woodworking factory on Main St. Estimated cost, $50,000. Architect not selected.

Wis., Peshtigo—J. L. Chudacoff plans to build a 2 story, 60 x 115 ft. knitting mill on Thompson St. Estimated cost, $75,000. Architect not selected.

Wis., Wausau—The Bd. Educ., c/o S. B. Tobrey, Supt., plans to build a 4 story, 60 x 200 ft. central school, including a vocational department, on Main St. Estimated cost, $200,000. Architect not selected.

WEST OF THE MISSISSIPPI

Ia., Ottumwa—J. Morrell & Co., Ottumwa, (pork packers) is having plans prepared for the construction of a 4 story, 102 x 182 ft. plant and a 4 story, 52 x 55 ft. smokehouse. Estimated cost, $500,000. Henschein & McLarsen, 37 West Van Buren St., Chicago, Ill., Archts.

Mo., St. Louis—The Polar Wave Ice & Fuel Co., c/o T. C. Muckermon, Pres., Grand and Olive Sts., is having plans prepared for the construction of a 2 story ice plant on Gravois Ave. and Decolsey St. About $50,000. H. G. Clymer, Wainwright Bldg., Archt.

Mo., Kansas City—The City Ice Co., 21st and Campbell Sts., will soon award the contract for the construction of a 42 x 80 ft. ice plant on 20th and Washington Sts. Estimated cost, $75,000. G. Carmen, Gumbell Bldg., Archt.